

FACT SHEET FOR STATE WASTE DISCHARGE PERMIT ST- 5213

Basic American Foods

SUMMARY

Basic American Foods owns and operates a potato processing facility near Moses Lake, WA (Grant Co.). Approximately one million gallons per day of process wastewater is land applied year around to approximately 2300 acres via center pivot irrigation. Supplemental water is provided from 17 on-site wells.

Past wastewater application and farm practices at the sprayfield site have adversely impacted the ground water beneath the site. Nitrate levels exceed the ground water criteria in a plume that nearly extends the length of the sprayfield site. An independent review of the design and ground water information for the land treatment system concluded that the Permittee's sprayfield system appears to be continuing to impact the ground water beneath the site. However, annual sprayfield reports appear to show water and nitrogen loadings to the site are generally less than the crop requirements. The permittee has informed Ecology of its intent to respond to the independent review.

The proposed permit will limit the application of wastewater to the design treatment capabilities of the crops on the sprayfields as presented in BAF's engineering report for the site. Restrictions will be placed on how soil salinity will be controlled. Best management practices will also be included to reduce the potential of soil percolate from the fields to impact ground water.

Sampling of the wastewater, soils, ground water, and crops will continue. The submittal of annual irrigation and crop plans will be continued to demonstrate that the system is in compliance with the permit limitations and BMPs, and to show that the system is operated as it was designed.

BAF will be required to submit a vadose zone monitoring plan. Data will be used to validate estimated soil percolate nitrate values that were used in a risk analysis by BAF to assess the potential impacts to the ground water from their current sprayfield system, and a better understanding of the nitrogen dynamics in the soils during the season when the potential for leaching of nitrates is high.

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INTRODUCTION

This fact sheet is a companion document to the draft State Waste Discharge Permit No. **ST-5213**. The Department of Ecology (the Department) is proposing to issue this permit, which will allow discharge of wastewater to waters of the State of Washington. This fact sheet explains the nature of the proposed discharge, the Department's decisions on limiting the pollutants in the wastewater, and the regulatory and technical bases for those decisions.

Washington State law (RCW 90.48.080 and 90.48.162) requires that a permit be issued before discharge of wastewater to waters of the state is allowed. Regulations adopted by the state include procedures for issuing permits (Chapter 173-216 WAC), and water quality criteria for ground waters (Chapter 173-200 WAC). They also establish requirements which are to be included in the permit.

This fact sheet and draft permit are available for review by interested persons as described in Appendix A--Public Involvement Information.

The fact sheet and draft permit have been reviewed by the Permittee. Errors and omissions identified in these reviews have been corrected before going to public notice. After the public comment period has closed, the Department will summarize the substantive comments and the response to each comment. The summary and response to comments will become part of the file on the permit and parties submitting comments will receive a copy of the Department's response. The fact sheet will not be revised. Changes to the permit will be addressed in Appendix D--Response to Comments.

GENERAL INFORMATION	
Applicant	Basic American, Inc.
Facility Name and Address	Moses Lake Facility of Basic American Foods, 538 Potato Frontage Rd, Moses Lake, WA 98837
Type of Facility	Potato Processor
Type of Treatment:	Land Treatment via spray irrigation
Discharge Location	2 miles SE of Moses Lake along State Hiway 17 Latitude: 47° 03' 27.9" N Longitude: 119° 15' 59.7" W.
Legal Description of Application Area	Approx 2300 acres located 2 miles SW of the processing facility in: Sec. 11, 14, 15, 22, and 23, T. 18N., R. 28 E. Latitude: 47° 02' 37" N. Longitude: 119° 16' 49" W.
Contact at Facility	Name: Mike Dodds, Resource Manager Telephone #: 509.766.7876
Responsible Official	Name: Brian Meiners Title: Plant Manager Address: 538 Potato Frontage Rd, Moses Lake, WA 98837

GENERAL INFORMATION	
	Telephone #: 509.766.7876 FAX # 509.766.3232

BACKGROUND INFORMATION

DESCRIPTION OF THE FACILITY

Basic American Foods owns and operates a potato processing facility that is located approximately three miles south of the city of Moses Lake (Grant Co.) along state hiway 17 (Fig. 1). Except for periodic down-time periods for sanitation and maintenance, the facility operates year around and processes approximately 400×10^6 pounds of raw potatoes into 70×10^6 lbs of dehydrated potato granules.

INDUSTRIAL PROCESSES

Freshly harvested and/or stored potatoes are trucked to the facility and off-loaded at the raw receiving area where they are washed and then flumed into the processing facility. The dehydration process includes: steam peeling, cooking, blending, dehydration, and packaging.

There are two main process wastewater streams: mud-water from the raw receiving area where the potatoes are off-loaded and washed and flumed into the processing facility, and process wastewater from the main dehydration facility.

TREATMENT PROCESSES

Flume/wash water

The flow volume of the mud-water discharge is approximately 50,000 gpd. The raw receiving water is circulated and reused as much as possible before being discharged. When discharged it is sent to a mud removal system where the mud is settled out. The water is sent to the main process wastewater system and the mud is removed and land applied.

Process wastewater

Wastewater from the dehydration facility makes up the bulk of the wastewater discharged from the dehydration facility; approximately 0.85 mgd. It is collected in a floor drain system and gravity flows to a screen system. The screened water then flows to a wastewater pump station to be sent to the land treatment site.

The combined waste streams are pumped to the land treatment site from the wastewater pump station where two pumps (primary and backup) are located, each capable of handling the entire waste stream. Wastewater flow from the pumps is sent through an 800-micron self cleaning filter and then to the fields.

LAND TREATMENT SYSTEM

The land treatment site is located approximately 1.5 miles SW of the processing facility in the sand dune area adjacent to the Potholes Reservoir (Figs. 1 and 2). It is comprised of 23 center pivots totaling approximately 2300 acres. Supplemental irrigation water is provided by 17 wells located throughout the site. According to the O&M Manual (BAF, 2001), there are two operator personnel for the site and are accountable for the day-to-day operations of the site; planning,

scheduling, and coordinating daily operations and maintenance. Irrigation and crop management of the sprayfield site is done by a hired consultant.

History

The BAF facility began irrigating its process wastewater in 1966 on a 206 acre site. It was operated as a high rate filter/treatment system. Wastewater was applied until saturation to promote denitrification, and then allowed to rest to promote nitrification. The hydraulic load was approximately 5ft/acre/year. This operation continued until 1992.

In 1992 BAF began to improve and expand its sprayfield system to 455 acres to reduce nutrient and water loading. The expansion was completed in 1994 (fields 16-19, Fig. 2) and included the conversion of the original 206 acres to center-pivot irrigation systems and the leveling of the sand-dune topography to install the new center-pivot acreage. The construction of the new sprayfields displaced approximately 8×10^6 yards of sand material. The completed sprayfields are sometimes referred to as the BAF fields.

The sprayfield expansion continued in 1996 by entering into a long-term agreement with an adjacent land owner to add approximately 1850 acres of center-pivot fields (fields 1-15; Fig. 2). The expansion was completed in 1998. These are referred to as the I/C fields in recognition of the land owner; Isaak Cox.

Sprayfield Operation

Process wastewater is applied to the land system year around. The “backbone” of the system consists of approximately 900 acres that is permanently cropped in alfalfa and winter wheat. The BAF fields and some I/C fields generally make up this alfalfa acreage and receive the bulk of the process wastewater loading during the year, especially during the growing season. The remainder of the system (I/C fields) has a variety of crops (wheat, corn, potatoes) that are managed for production agriculture purposes; irrigated with freshwater and fertilized with commercial fertilizer when needed. During the Fall/winter non-growing season, the I/C fields receive most all of the process wastewater loadings.

Sprayfield Design

An engineering report for the system has been submitted to Ecology (CES, 2001b) and the following design values were determined:

1. Nitrogen: Based on the lowest annual nitrogen capacity for the entire site over a 5-year crop rotation, the annual design nitrogen capacity for the site is 477,000 lbs (gross). This compares to an estimated annual processing plant output of 450,000 lbs. It was estimated that approximately 170,500 lbs of nitrogen (38% of total) will be applied to the I/C fields during the non-growing season; November – February.

The design of the land treatment system included “target” maximum nitrogen loads for the alfalfa fields (440 lbs/acre) and for these fields when they are rotated into wheat (175 lbs/acre). The target load value for the remaining fields is 175 lbs/acre.

2. Flow: A design annual process wastewater flow of 520 MG was used; 340 MG during the summer growing season (March-October) and 180 MG (35% of total) during the winter non-growing season.
3. Water: The annual output of process wastewater will not meet the water demand of the crops. Approximately 1850 MG of supplemental water will be required to meet the total crop demand.
4. Salts: Loading to the site will range from 890 to 3300 lbs/acre (avg = 1700 lbs/acre). Salt loading will be managed using generally accepted agricultural BMPs for leaching to control the soil salinity not to exceed 2 mmhos/cm in the root zone. The average leaching requirement (LR) for the site to control the soil salinity is 7.6% or 4.4 inches. Irrigation will be managed so that the amount of water leached below the root zone (Leaching Fraction, LF) is less than the leaching requirement; $LF \leq LR$.
5. BOD: The design value for the site was determined to be 32.7×10^6 lbs/day. This was determined based on not exceeding a maximum daily load of 100 lbs/acre/day. The current BOD output from the processing facility is approximately 4×10^6 lbs.

Sprayfield Hydraulic Loading

A review of the annual Irrigation and Crop Management Plans (ICMPs) for the sprayfields (2000-2004) showed that the amount of wastewater applied to all fields was far below the amount required by the crops (SoilTest, 2004; 2005). Using 2004 as an example, wastewater provided approximately 29% of the water need for the alfalfa fields and approximately 8% for the I/C fields.

The 2001 engineering report determined the proportional annual hydraulic loading for the site: 18% from process wastewater; 20% from precipitation; 62% supplemental fresh (ground) water.

Sprayfield Nitrogen Loading

Gross nitrogen load and balance information in the annual ICMPs for the entire site (BAF and I/C fields) were reviewed.

	Avg. alfalfa field load (lbs/acre)	Avg. alfalfa field uptake (lbs/acre)	Avg. I/C field load ¹ (lbs/acre)
2000	245	252	Not reported
2001	198	364	87
2002	190	425	52
2003	190	428	68
2004	142	484	40
¹ values do not include loads from commercial fertilizers or supplemental water			

Wastewater nitrogen load values for the alfalfa and I/C fields have been well below the design target maximum values; 440 and 150 lbs/acre, respectively. Nitrogen uptake by the alfalfa was generally greater than the amount of nitrogen applied to the fields. Nitrogen uptake and balance information has not been reported for the other I/C fields.

In contrast to the wastewater loadings to the I/C fields, the commercial fertilizer nitrogen loading to these fields has been substantially greater than the wastewater loads. Information in the 2003 and 2004 ICMPs shows that the commercial fertilizer load values ranged from 116 to 331 lbs/acre, with the averages being 206 and 235 lbs/acre, respectively. Both values exceed the target load value determined by BAF for the I/C fields. In addition, the nitrogen contribution by the supplemental irrigation water has not been reported.

Sprayfield Total Dissolved Salt Loading

Values for IDS loading are only available for two years:

2003: alfalfa fields – 1555 to 2172 lbs/acre
I/C fields – 14 to 1256 lbs/acre

2004: alfalfa fields – 1280 to 1780 lbs/acre
I/C fields – 30 to 2150 lbs/acre

These load values do not include salts contributed by the supplemental irrigation water or any commercial fertilizers that were applied.

The salt load values appear to be comparable to other potato and vegetable processors that use land treatment systems in eastern Washington; salt loading generally exceeds the crop requirements. The amount of land that would be needed for the crops to utilize the amount of salt that is applied (treatment) would be cost prohibitive to bring online and operate. As described in the engineering report for the site, irrigation BMPs will be used to manage the salt load by leaching only that amount that is necessary to maintain good crop production; leaching fraction \leq leaching requirement.

Water Balance Model Risk Assessment

In response to Ecology's concerns about the ability of BAF's year around application of wastewater to protect the ground water, especially during the winter non-growing season, BAF submitted an addendum to the engineering report that evaluated the risk of ground water impact from year around application vs. seasonal storage during the winter non-growing season; CES, 2003.

The water balance model estimated the percent of total soil profile nitrate-nitrogen that would be in the percolate from the root zone for two irrigation scenarios: during the winter period (November – February) for year around, and from the site using storage during the winter non-growing season.

The model results showed:

1. When leaching was done in the fall (November), nitrate loss in the percolate was the same, on average, for both the year around and seasonal storage scenarios.

2. When leaching was done in the winter (February), nitrate loss was 2.8% higher for the year around irrigation scenario than for winter storage.

Several statistical tools were used to determine whether the difference in winter leaching was significant. The Students-T test for paired means was used for the following null hypothesis:

H_0 : Year-around percolate nitrate loss minus winter storage nitrate loss = 0

H_A : Year-around percolate nitrate loss minus winter storage nitrate loss > 0

It was determined that the probability that there is no difference in nitrate percolate loss between the year around and winter storage irrigation scenario is near 100%. The hypothesis that the average percolate nitrate loss from year around irrigation is not different from that for the winter storage scenario is strongly supported; accept H_0 . The risk to ground water from nitrate leached during year around application is the same as that for irrigating only during the non-growing season and winter storage.

GROUND WATER

A description and analysis of the geology and ground water beneath the sprayfield site was presented in a hydrogeologic report (CES, 2001a) and in Attachment G5 to the permit application. The site is underlain by basalt and the surface soils are comprised of glacio-fluvial dune sands and gravels.

There are two aquifer types at the sprayfield site: an overburden porous aquifer and a deeper fractured basalt aquifer. The deeper basalt aquifer is the most significant water bearing zone and is where most all irrigation wells are completed. Given the large amount of water that is pumped throughout the area for irrigation, the water level in both systems fluctuates with levels rising in the winter and falling in the summer, the most dramatic fluctuations occur in the basalt aquifer.

The porous sandy soils and proximity of the site to the Potholes Reservoir has resulted in a hydraulic continuity between the ground water and the reservoir. Ground water flow is to the southwest (Fig. 3) towards the reservoir.

Moses Lake POTW

The city of Moses Lake owns and operates a sanitary wastewater treatment system located at the northeast corner of the sprayfield site; Fig. 2. The "Dunes" facility was constructed in 1984 and consists of aeration and settling lagoons with final discharge to rapid infiltration basins. The facility is permitted for 2.5 MGD.

The city is in the final stages of completing an upgrade to an extended aeration system with UV disinfection, and discharge to infiltration basins. The system was designed to produce an effluent with a maximum daily TN and nitrate concentration of 10 and 6 mg/L (as N), respectively, and an average monthly CBOD₅ of 15 mg/L. The average monthly design flow is 3.71 MGD.

MODFLOW modeling

The HG report evaluated seasonal steady-state ground water flow (summer and winter) using MODFLOW. Results showed the following:

1. A plume of nitrate impacted ground water extends in a S-SW direction across the sprayfield site from the old BAF field site and Dunes POTW; Fig. 4 and 5. The extent of the plume depends on the season; winter or summer.
2. The 17 irrigation wells at the site capture 99.9% of the ground water traveling beneath the site in the summer.
3. Approximately 467 MG of percolate loss enters the ground water beneath the sprayfield site in the winter.
4. The velocity and volume of the ground water beneath the site significantly reduces in the winter.
5. MW1, 2, 3, and 12 represent upgradient conditions.

Ground Water Quality

The HG report analyzed trends in the ground water database for samples collected from BAF's 10 monitoring wells located throughout the sprayfield site (Fig. 2). The current wells were installed over a three year period; 1994-97. All were generally completed in the upper aquifer (sand) and range in depth from 35 to 80ft. The data analysis was for the period 1994 through 2000. Based on this review the report concluded:

1. Past agriculture practices used for the I/C fields have impacted ground water.
2. The discharge from the city of Moses Lake Dunes POTW has impacted the ground water upgradient of the sprayfield site.
3. The original 206 acre sprayfield site has impacted the shallow ground water aquifer.
4. The land leveling and soil disturbance associated with the reconstruction of the old BAF fields and construction of the current fields caused nitrates to be generated from stored nitrogen (via nitrification) in the soils and be released to the ground water.

Upgradient (Background) Ground Water Quality

Ground water monitoring data for the period January 2001 – May 2005 for the site's four upgradient wells (Addendum 1) was used to estimate the upgradient (background) ground water quality for BAF's sprayfield site. The wells (MW-1, -2, -3, and -12; Fig. 2) were identified in the 2001 HG report as being representative of upgradient conditions.

The statistical method described in Ecology's ground water implementation guidance was used to estimate background values (95% upper tolerance limit; UTL. Ecology, 1996). The analysis included an evaluation of outliers, seasonality, and a trend analysis. A description of the analysis is in Appendix C. A graphical presentation of the statistical analysis is shown in Addendum 2.

The UTL (background ground water quality) values for the site are:

	<u>MW1</u>	<u>MW2</u>	<u>MW3</u>	<u>MW12</u>
NO ₃	2.5 mg/L	14 mg/L	7.3 mg/L	7.8 mg/L
TDS	212 mg/L	651 mg/L	615 mg/L	423 mg/L

MW-1

Nitrate: Based on seasonality adjusted values, there was a significant decreasing trend in the data set; n = 53. To eliminate the decreasing trend, all data for Jan 01-Mar 02 were eliminated from the analysis. The remaining data set (n=38) was used for determining the background nitrate value; 2.5 mg/L.

TDS: Seasonality and a decreasing trend were also found for the TDS data set. The background value (212 mg/L) is based on the Aug 03-May 05 data set; n = 22.

MW-2

Nitrate: There was a significant decreasing trend in the data set. All data for Jan 01-May 03 were removed to eliminate the trend. The background value (14 mg/L) is based on June 03-May 05 data; n = 10.

TDS: After the removal of outlier values (April 04) from the data set, there was a significant decreasing trend in data set. Data for Jan 01-Mar 04 was removed to eliminate the trend and the outlier Oct. 04 data point was removed. The background value (651 mg/L) is based on the April 04-May 05 data; n = 7.

MW-3

Nitrate: The data set (n=19) was insufficient to test for seasonality because, in part, there was insufficient well volume to sample. There was no significant trend in the data set.

TDS: There was a significant decreasing trend in the data. The background value is based on April -1-May 05 data; n = 16.

MW-12

Nitrate: After the removal of outlier values (Aug 01 and Aug 03), there as no seasonality or trend in the data set; n = 50.

TDS: There was a significant decreasing trend in the data set. After the removal of the Jan 01 – April 03 data, and then the removal of the July 03 outlier, the background value is based on the May 03-May 05 no-trend data; n = 24.

The only background value to exceed the nitrate standard (10 mg/L) occurred at MW-2, which is along the eastern periphery of the original 206 acre sprayfield and downgradient of the Dunes POTW. The background TDS values at MW-2 and -3 exceeded the ground water standard; 500 mg/L.

In general, the nitrate and TDS ground water data sets (Jan 01 – May 05) showed a significant decreasing trend (at 96% C.I.) at each well. As explained in Appendix C, data values were progressively eliminated (earliest to latest) until no trend was found. The smallest data set used for the background was for TDS at MW-2; n = 7. A decreasing trend in the ground water data at the upgradient wells was also found for the January 1996 – December 2001 ground water data when background values were determined in the Fact Sheet for the current permit that was issued in 2000.

Downgradient Ground Water Quality

Ground water nitrate and TDS data for the down gradient wells (MW6, 8, 9, 10, 11, and 13) for the period 1996/97 through May 2005 was analyzed for trends (Addendum 3). Regression lines were determined from the data and the significance of the trends was determined using the Sen's slope estimator.

MW-6:

This well is located closest to the original 206 acre sprayfield site that was heavily loaded with wastewater for 25 years; Fig. 2. Nitrate values have significantly increased since 1996. Seasonal peaks appeared to occur in the winter (January) and the lowest values occurred in the Spring (May). Values for TDS also showed a significant increase. Values for both parameters greatly exceed their respective ground water standard values.

MW-8:

Nitrate values have significantly declined since 1997 while values for TDS have remained relatively unchanged. This well is located farther downstream of the original sprayfield site and somewhat outside of the nitrate plume; Fig. 4.

MW9:

This well is located along the southern periphery of the site and also somewhat outside of the nitrate plume; Fig. 4. Nitrate values have significantly increased since November 1997. Values for TDS have shown some seasonal spikes in excess of the ground water standard (500 mg/L), but have not showed a significant trend in either direction.

MW10:

This well is located at the most southern extent of the sprayfield site; Fig2. Values for both nitrate and TDS appear to show a slight increase but neither are significant. The increase may be due to the approaching nitrate plume; Fig. 4.

MW11:

This well is located along the western boundary of the sprayfield site and well outside of the nitrate plume. The analysis for the nitrate data shows an increasing regression line, but a slight decreasing trend. Ground water TDS concentrations at the well show a significant decreasing trend.

MW13:

This well is located within the boundaries of the sprayfield site and along westerly edge of the nitrate plume. Nitrate values sharply increased from November 1997 to 2002. Thereafter, values began to decline and have continued in a significant trend to May 2005. Values for TDS show a similar pattern of increase from November 1997 to 2002, but the decline since 2002 has not been significant.

Nitrate and TDS concentrations in the groundwater immediately downgradient of the original 206 acre sprayfield site continue to increase in a significant manner. Nitrate and TDS in the downgradient wells along the western and southern boundary of the site appear to be declining or unchanging.

For the downgradient wells along the eastern boundary of the site, nitrate concentrations in the ground water appear to be increasing and TDS values remaining relatively constant.

STORMWATER

A Stormwater Runoff Plan has been prepared by BAF and was included with the permit application. Runoff from areas of the processing facility site discharges to different locations, and include the Rocky Coulee, and onsite natural pond, along the southern boundary of the site, and to an onsite stormwater pond. Water collected in the stormwater pond is either evaporated or pumped to the sprayfields. The facility does not have a state issued baseline stormwater permit.

TECHNICAL REVIEW

State law requires that all dischargers must apply AKART (all known available and reasonable methods of treatment, prevention, and control) to their wastewater prior to discharge to waters of the state. AKART for a discharger is generally described in an engineering report that is approved by Ecology. Ecology recently adopted guidance that, in part, describes what the Department has approved as AKART for land treatment systems (Ecology, 2005). To reliably protect ground water, the guidance requires, in part, that wastewater generated during the winter non-growing season be stored in an approved lined impoundment.

The guidance does allow a site specific demonstration of innovative approaches to land treatment systems that depart from what has been approved. Ecology will allow these new treatment methods so long as they can show a demonstrated equivalent level of protection of the ground water to what has been approved as AKART.

BAF has submitted to Ecology sprayfield design, hydrogeologic and ground water modeling information, as well as a risk analysis in an attempt to show for their sprayfield site that year around application of wastewater is equally protective of the ground water beneath the site as that would be provided by winter storage; AKART.

To assist Ecology in determining whether the current year around land treatment system is AKART and protective of the ground water, it was decided to have a third party review of the BAF reports. An interagency agreement was entered into between Ecology and Washington State University (Biological Systems Engineering Dept.) to review the engineering and

hydrogeologic reports. The review was to determine, in part, if AKART is provided by BAF's year-around land treatment system.

BAF and its consultant graciously provided WSU with all of the necessary ground water and model input data that were used in the HG and modeling analysis (CES, 2001a). A final technical report has been submitted (WSU, 2005). The review was done in three parts: 1) engineering report; 2) ground water modeling and quality analysis; 3) ground water model re-run.

Engineering Report

The review did not include an evaluation of the design nitrogen load to the fields because the design did not consider any nitrogen losses via volatilization and denitrification. The design gross nitrogen load from the processing facility (450,000 lbs/yr) is less than the treatment capacity of the sprayfield (477,000 lbs), therefore excess nitrogen loading should not be an issue.

The reviewers did note that the sprayfield soils have a low cation exchange capacity (CEC), and that the application of the wastewater with high NH_4^+ and potassium concentrations would overcome the CEC of the soils and increase the potential of NH_4^+ leaching into the ground water.

The reviewers also suggested that wastewater should not be applied in the late Spring. As soil temperatures increase so does the nitrification of the soil-stored NH_4^+ . Crop growth is still somewhat limited in the Spring and the potential for leaching nitrates and soluble salts into the ground water is high.

The following recommendations were made:

1. add soil pH testing to the site's monitoring requirements
2. add NH_4^+ testing in the ground water
3. modify the soil sampling to include sampling at the 0.5 and 1.5ft depths, and to increase the frequency of the nitrate soil sampling.

Hydrogeologic Report

The two main parts of the HG report for the sprayfield site were reviewed; MODFLOW modeling and ground water quality analysis.

- A. It was the reviewer's opinion that the setup of the MODFLOW model was problematic, and resulted in unsupported conclusions about the ground water beneath the sprayfield site. The most notable was that 99.9% of the ground water is captured by the irrigation wells during the summer. The reviewers re-visited the source and sink terms in the ground water balance and determined that approximately 36% of the ground water is captured. This new value was supported by re-running the MODPATH (particle tracking) portion of the model which showed that the irrigation wells had less of an impact on ground water capture.
- B. The review of the up- and downgradient well data appeared to indicate that the BAF and I/C fields that were brought on-line after 1997 have added to the nitrate and chloride plume that extends from the old BAF field site. The ground water database does not

allow the determination of the impacts are from summer or winter applications, or if the source of nitrogen is from the wastewater or commercial fertilizer.

MODFLOW model re-run

The reviewers revised the settings and re-ran the MODFLOW ground water model. Four runs were made: runs 1-3 were under steady-state flow but transient solute transport; run 4 was under transient flow and solute transport. Results of the model re-run confirmed that the BAF sprayfields is the single most significant contributor of chlorides and nitrates to the pollutant plume that extends across the site from the original BAF sprayfields. Additional monitoring is needed (i.e., vadose zone) to determine if winter and/or summer applications of wastewater is causing the leaching of nitrates to the ground water.

Conclusions

The technical report concluded that:

1. The overall ground water quality has been adversely impacted by the BAF sprayfields.
2. It is difficult to evaluate the BAF land treatment system as AKART
3. It is not certain that the land treatment system is appropriate for the existing and future beneficial uses of the ground water in terms of nitrate concentration according to the state's water quality standards (WAC 173-200).

(NOTE: BAF has informed Ecology of its intent to rebut the allegations of the independent review)

PERMIT STATUS

The previous permit for this facility was issued on November 1, 2000.

An application for permit renewal was submitted to the Department on May 10, 2005.

SUMMARY OF COMPLIANCE WITH THE PREVIOUS PERMIT

During the history of the previous permit, the Permittee has generally remained in compliance based on Discharge Monitoring Reports (DMRs) and other reports submitted to the Department and inspections conducted by the Department.

The only non-compliance issue has been not reporting all of the information required in the annual irrigation and crop management plan. Specifically, estimated water, nutrient and salt balances for the I/C fields, and salt balances for the BAF fields.

WASTEWATER CHARACTERIZATION

The concentration of pollutants in the discharge was reported in the permit application and in discharge monitoring reports. The proposed wastewater discharge prior to spray irrigation is characterized for the following parameters as given in the permit application from 24hr composite samples:

Table 1: Wastewater Characterization

<u>Parameter</u>	<u>Concentration</u>
BOD ₅	Range: 4-984 mg/L; Avg. = 683 mg/L
Ammonia-N	Range: 0-41mg/L; Avg = 25.5 mg/L
pH	Range: 6.3 – 7.2 s.u.
Total Kjeldahl Nitrogen	Range: 0-80 mg/L; Avg = 52.5
Total Phosphate (as P)	Range: 6.5-16.2 mg/L; Avg. = 12.1 mg/L
Calcium	Range: 7-9.8 mg/L; Avg. = 8.4 mg/L
Chloride	Range: 79.4-146 mg/L; Avg = 119 mg/L
Bicarbonate	Range: 352-504 mg/L; Avg. = 430 mg/L
Magnesium	Range: 5.3-8.6 mg/L; Avg. = 7.5 mg/L
Potassium	Range: 82.3-185 mg/L; Avg = 143 mg/L
Sodium	Range: 121-177 mg/L; Avg. = 140 mg/L
Sulfate	Range: 6.1-25 mg/L; Avg. = 15.8 mg/L

The organic strength of the BAF wastewater appears to be less than that from french fry-type potato processors that are more common in the area. The average BOD values for these process wastewaters is generally in the range of 1000 to 1500 mg/L. The lower organic strength of the BAF wastewater could be due to a less intensive peeling process and not using fry oil in the process.

Another difference in the BAF wastewater is the average TKN concentration; it is about one-half to one-third that for a french fry facility. The lower TKN concentration may be related to the lower organic concentration.

PROPOSED PERMIT LIMITATIONS

State regulations require that limitations set forth in a waste discharge permit must be either technology- or water quality-based. Wastewater must be treated using all known, available, and reasonable treatment (AKART) and not pollute the waters of the State. The minimum requirements to demonstrate compliance with the AKART standard were determined in the engineering reports (CES, 2001; 2003), in conformance with *Guidelines for the Preparation of Engineering Reports for Industrial Wastewater Land Application Systems*, May 1993.

The permit also includes limitations on the quantity and quality of the wastewater applied to the sprayfield that have been determined to protect the quality of the ground water. The approved engineering report includes specific design criteria for this facility. Water quality-based limitations are based upon compliance with the Ground Water Quality Standards (Chapter 173-200 WAC).

The more stringent of the water quality-based or technology-based limits are applied to each of the parameters of concern. Each of these types of limits is described in more detail below.

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

All waste discharge permits issued by the Department must specify conditions requiring available and reasonable methods of prevention, control, and treatment of discharges to waters of the state (WAC 173-216-110). The following permit limitations are necessary to satisfy the requirement for AKART:

1. Wastewater shall be land applied via spray irrigation not to exceed agronomic rates (as defined in the Department's ground water implementation guidance) for total nitrogen and water, and at rates for other wastewater constituents that are protective of background ground water quality.
2. Total nitrogen and water shall be applied to the sprayfields not to exceed the design values given in the November 2001 engineering report for the site.
3. The system must be operated so as to protect the existing and future beneficial uses of the ground water and not cause a violation of the ground water standards.
4. The wastewater flow to the fields shall not exceed 520 million gallons per year.
5. The gross nitrogen load to the sprayfield site shall not exceed 477,000 lbs per year.
6. Crop specific gross nitrogen loading shall be limited to:
 - a. Alfalfa: 440 lbs/acre
 - b. Winter wheat: 175 lbs/acre
 - c. I/C fields: 150 lbs/acre
7. The leaching fraction for the site shall not exceed 7.6% (4.4 inches).
8. Whenever leaching is planned to control soil salinity, the leaching requirement shall be met using precipitation and/or fresh irrigation water.
9. The BOD load to the fields shall not exceed 100 lbs/acre/day.

GROUND WATER QUALITY-BASED EFFLUENT LIMITATIONS

In order to protect existing water quality and preserve the designated beneficial uses of Washington's ground waters including the protection of human health, WAC 173-200-100 states that waste discharge permits shall be conditioned in such a manner as to authorize only activities that will not cause violations of the Ground Water Quality Standards. The goal of the ground water quality standards is to maintain the highest quality of the State's ground waters and to protect existing and future beneficial uses of the ground water through the reduction or elimination of the discharge of contaminants to ground water [WAC 173-200-010(4)]. This goal is achieved by [GW Implementation Guidance, Abstract, page x]:

1. Requiring that AKART (all known available and reasonable methods of prevention, control and treatment) be applied to any discharge;

2. Application of the antidegradation policy of the ground water quality standards. This policy mandates protecting background water quality and preventing degradation of water quality which would harm a beneficial use or violate the ground water standards; and
3. Establishing numeric and narrative criteria for the protection of human health and welfare in the ground water quality standards.

Applicable ground water criteria as defined in Chapter 173-200 WAC and in RCW 90.48.520 for this discharge include the following:

Table 2: Ground Water Quality Criteria

Total Dissolved Solids	500 mg/L
Nitrate	10 mg/L

Enforcement Limits

Several factors make it difficult to use the estimated background ground water quality values to establish ground water enforcement limits for the entire BAF sprayfield site:

1. Ground water modeling (CES, 2001a) shows that a plume of nitrate rich ground water extends from the old original BAF sprayfield site to near the southern boundary of the site (Fig. 4 & 5). The extent of the plume changes with the season because of the affects of pumping from the irrigation wells. Most of the downgradient wells that would be used for compliance with the enforcement limits are completed within the plume. Nitrate concentrations in these wells are high. The average values for MW6, 9, 10, and 13 range from 32.8 – 52.5 mg/L. The northwestern and western sprayfields are the only sites not above the plume throughout the year.
2. Establishing enforcement limits for nitrate and IDS at MW-11 for the western sprayfields would cause the permittee to be in immediate non-compliance for both parameters. Values for nitrate at MW-11 have ranged from 13.5 to 52.4 mg/L (January 2001 – May 2005), and values for TDS ranged from 472 to 787 mg/L. These compare to the background (enforcement) values of 7.8 mg/L for nitrate and 423 mg/L for TDS.

The HG report (CES, 2001a) concluded that elevated nitrate and chloride values at MW-11 were from commercial fertilizers and not the wastewater. This was based on the short time the I/C fields, upgradient from MW-11, have been used for wastewater treatment (1998) and that the application volumes have been low.

3. The upgradient background values at MW-1, -2, and -3 are based on relatively small data sets. While the number of values meets Ecology's guidance minimum for background determination (n = 8), it must be remembered that the small data sets are a part of an overall decreasing trend for the entire data base for both nitrate and TDS.

4. The background values determined for this Fact Sheet are less than those determined in the Fact Sheet for the current permit (issued 2000). This reflects the general decreasing trend in ground water concentrations at the upgradient wells for nitrate and TDS.

2000 permit:

	<u>MW1</u>	<u>MW2</u>	<u>MW3</u>	<u>MW12</u>
NO ₃	11.2 mg/L	17.8 mg/L	22.3 mg/L	13.2 mg/L
TDS	293 mg/L	747 mg/L	675 mg/L	515 mg/L

Proposed permit:

	<u>MW1</u>	<u>MW2</u>	<u>MW3</u>	<u>MW12</u>
NO ₃	2.5 mg/L	14 mg/L	7.3 mg/L	7.8 mg/L
TDS	212 mg/L	651 mg/L	615 mg/L	423 mg/L

Given the modeling and ground water quality information that has been presented and discussed in the HG report (CES, 2001a), and data that has been submitted to Ecology, it has been decided that enforcement limits will not put in the proposed permit. Enforcement limits will be revisited when the next permit is issued.

Instead of enforcement limits, changes will be required in the management of the sprayfield site and the sprayfield reporting requirements in the permit. These changes will be based, in part, on suggested monitoring and compliance recommendations developed by BAF for their site (CES, 2003).

COMPARISON OF LIMITATIONS WITH THE EXISTING PERMIT ISSUED NOVEMBER 1, 2000

Table 3: Comparison of Previous and New Limits

Parameter	Existing Limits	Proposed Limits
annual avg. flow applied to irrigation lands	1.35 MGD	1.42 MGD
maximum monthly average flow to irrigation lands	1.66 MGD	1.66 MGD
Total annual wastewater flow from processing facility	*****	520 MG

The change in the annual average flow limit is based on the total annual flow sprayfield design capacity value that was described in the engineering report (CES, 2001b), and on information presented in the permit application.

MONITORING REQUIREMENTS

Monitoring, recording, and reporting are specified to verify that the treatment process is functioning correctly, that ground water criteria are not violated, and that effluent limitations are being achieved (WAC 173-216-110).

MONITORING

The monitoring schedule is detailed in the proposed permit under Condition S2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring.

IRRIGATED PROCESS WASTEWATER MONITORING

The testing requirements that are in the current permit for the process wastewater irrigated onto the sprayfields will be rolled over into the proposed permit. "Total dissolved solids" testing will be added to the test parameter list. This will provide data that will give a better understanding of the inorganic salt load to the fields.

Testing for the list of cations and anions will be decreased from quarterly to twice per year. Quarterly testing has been required for the past two permit cycles and a reduction in sampling has been determined to be warranted.

A concern of Ecology relative to the year around application of wastewater has been whether the Spring-time mineralization of organic nitrogen stored in the root zone over the winter and the subsequent conversion of ammonia to nitrate via nitrification coincides with the crop's uptake requirements for nitrogen as soil and air temperatures increase. Soluble wastewater organics have the potential to percolate deeper into the root zone and cause mineralized and nitrified nitrogen (nitrate) to be less available to early crop growth and a higher potential to leach to the ground water.

In addition, the mineralization of the soluble organics produces organic acids which can cause the weathering of the soils and the release of salts such as calcium and magnesium. These can be leached out of the soil column and add to the TDS concentration in the ground water.

To gain a better understanding of the organic load to the sprayfields, soluble BOD testing of the irrigated wastewater will be required for one year. The results of both soluble and total BOD testing for the year will be presented to Ecology in a report.

FRESH IRRIGATION WATER MONITORING

The annual Irrigation and Crop Management Plan (ICM Plan) requires, in part, that nutrient, salt, and hydraulic loadings from the supplemental irrigation water be accounted for in the calculated nutrient, salt and water balances for each sprayfield. This is especially important for the I/C fields which receive most of their irrigation requirements from the onsite wells. Information in

the 2003-04 ICM Plan showed that approximately 28.4×10^9 gallons of freshwater was applied to the I/C fields, with an average application rate of 28 inches/acre.

To provide the data from which to calculate the freshwater loading to all fields, the permit will require some testing of the fresh irrigation water at each of the 17 wells. Testing will be for pH, ammonia, nitrate, and total dissolved solids. Ammonia and TDS will be done instead of TKN and fixed dissolved solids because of the near absence of organics in the ground water.

Testing will be done only once during the permit cycle; 2006. The single test values will be used to account for freshwater loadings in all annual irrigation and crop plans during this permit cycle.

CROP MONITORING

Crop monitoring was a requirement in the last permit and will be continued in the proposed permit. Reporting of the test results will be done in the annual irrigation and crop management plan. The data will be used to develop a nutrient, water and salt budget for the fields.

The list of cations and anions will be replaced with "ash weight" (mg/Kg, dry wt). The ash weight will provide an estimate of the total inorganic salt content of the plant tissue. This information will provide an estimate of the fixed dissolved solids uptake by the crop and allow for the determination of a dissolved solids balance for the sprayfields.

Crop sample collection for testing will be required for all grain/grass-type of crops (alfalfa; wheat; mint, etc.). Samples will be collected in a manner that best represents the uptake for each crop. These values will be used in the determination of the end-of-year nitrogen/nutrient, and water balance reporting requirements. For non-forage type crops (e.g., corn, potatoes), the use of literature values for nitrogen/nutrient uptake that are applicable to the area will be acceptable.

SOIL MONITORING

The current permit requires twice per year soil testing (beginning and end of crop season) for all BAF (alfalfa) fields and some selected I/C fields (#7, #10, #14). The testing includes a list of different soil parameters. A monitoring plan was subsequently developed by BAF (CES, 2003) that suggests the soils in all fields be monitored only for nitrate and salinity, and that the soil water profile be measured at least weekly on representative fields for each crop. The plan also suggests that a running, three year end-of-crop-year soil profile nitrate be generated, and that the fields be operated so there is a stable or decreasing trend.

It is understood that the I/C fields receive much less wastewater than do the BAF (alfalfa/wheat) fields that make up the backbone of the land treatment site. But, the small hydraulic load and nutrients supplied by the wastewater to the I/C fields must be supplemented by the addition of a large amount of freshwater and some commercial fertilizer to meet the crop demands.

Ecology believes that soil monitoring for this site is an extremely important irrigation and crop management tool, given the moderate depth to the ground water and the sandy well-drained soils. It has been decided that to account for the nutrients applied to the fields, the following soil testing will be required.

1. The soil testing requirements in the current permit will be continued for the BAF fields (alfalfa/wheat fields) and selected I/C fields but with some changes:

- a. Cation exchange capacity (CEC) will replace “soil moisture” because the moisture content changes continuously and a one time sample, twice per year gives limited long-term information.
- b. pH, “organic matter”, TKN, and “cation exchange capacity” testing will be done at several near surface soil depths instead of the entire 1-8ft root depth. It is intended that this information can be used to verify the nitrogen volatilization loss rate for the site and potential NH_4^+ loss via leaching.
- c. The total soil testing depth will be reduced from 8 to 6 feet. Chemical parameters that leach beyond this depth can generally be regarded as lost from root capture and plant uptake.

BAF’s sprayfield monitoring plan (CES, 2003) recommends sampling and testing soils in all fields for residual nitrate and salinity. In lieu of this testing, the permit will require the submittal of a vadose zone monitoring plan that will include the sampling of soil percolate from the BAF fields and selected I/C fields.

GROUND WATER MONITORING

Ground water monitoring in the current permit will be continued in the proposed permit. The testing for the list of cations and anions will be changed from “quarterly” to “once per year”.

Ammonium ion testing (NH_4^+) will be added to the list of test parameters. As explained in WSU’s technical evaluation report, the land application of relatively high levels of potassium in the process wastewater has the potential of exceeding the CEC of the soils and allowing ammonium nitrogen to leach to the ground water.

It is recognized that there is no ground water criteria for ammonium, but comparing up and downgradient well values offers insight into the impacts of applying high potassium wastewater onto well drained soils and with a moderate depth to ground water.

Sulfate testing will be added for a more complete list of the anion and cation test parameters. In addition, the field test for the presence/absence of ferrous iron will be added. This simple colorimetric test determines the presence of reducing conditions in the ground water that could be caused by breakdown of organics that have leached to the ground water. These test results will compliment the soluble BOD testing of the irrigated wastewater.

VADOSE ZONE MONITORING

As explained previously, BAF has evaluated the risk to ground water from their current year around land treatment system (CES, 2003). Risk was based on the estimated percent of total soil profile nitrate that would be leached to the ground water during the fall and late-winter.

In an effort to “ground truth” the results of the risk assessment modeling and get information on wastewater infiltration through the vadose zone and in lieu of soils testing at all fields, the permit will require BAF to submit a plan for the installation of a vadose monitoring system for the BAF site. The system will be designed to collect soil water at the base of the root zone in the BAF and I/C fields. Parameters of interest include: nitrate, ammonium, dissolved salts, potassium, and pH.

The plan will include a description of the O&M for the collection system that includes sample collection and preservation, and testing. A sampling schedule shall also be developed that includes the determination of the “% loss of residual soil nitrate”, the concentration of nitrate and chloride in the leachate, and the volume of water leached. These values can be compared to the values estimated in the risk analysis, and those estimated by the ground water model.

OTHER PERMIT CONDITIONS

REPORTING AND RECORDKEEPING

The conditions of S3 are based on the authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-216-110).

FACILITY LOADING

The design criteria for this treatment facility are taken from the engineering reports prepared by BAF and are as follows:

Average daily flow from the processing facility	1.42 mgd
Total annual process wastewater flow	520 MG
Total annual (gross) nitrogen load from processing facility ¹	477,000 lbs
Total annual BOD ₅ load from processing facility	32.7 x 10 ⁶ lbs

¹ For testing and reporting purposes, IN = TKN, because of the near absence of nitrate-N in the wastewater.

The permit requires the Permittee to maintain adequate capacity to treat the flows and waste loading to the treatment plant (WAC 173-216-110[4]). For significant changes in loadings to the treatment works, the permit requires a new application and an engineering report (WAC 173-216-110[5]).

IRRIGATION AND CROP MANAGEMENT PLAN

The submittal of an annual Irrigation and Crop Management Plan (ICM Plan) will continue. It is required to, in part, support the engineering report(s). This plan shall include a consideration of wastewater application at agronomic rates, and should describe and evaluate various irrigation controls.

BAF has proposed to prepare and submit field specific nutrient and water balances for those fields that receive more than 2 inches of process wastewater or any field where excess irrigation water is added for leaching purposes (CES, 2003). No rationale was given for the 2 inch limit, except that 2 inches of process wastewater applies approximately 32lbs of N.

Generally, it is Ecology's position that if any wastewater is applied to a field, then a nutrient and water balance must be determined and presented in the ICM Plan. For sites that apply “small” amounts of wastewater to the fields on an infrequent basis, Ecology has guidance for the de minimis application of wastewater. The annual scheduled use for most of the I/C fields to receive

wastewater during the winter months would not appear to meet the requirements for a de minimis application.

Based on the monitoring information for the wastewater and fresh irrigation water, the commercial fertilizer applications, and crop monitoring data the ICM Plan will:

1. Summarize the operations of the entire treatment site (BAF fields and all I/C fields) for the previous year and describe the operations for the upcoming year relative to wastewater, fertilizer, and supplemental water loadings (e.g., nitrogen, salt, and water loadings) based on the chosen crop rotation.
2. Compare the nitrogen loadings to each field (wastewater + fertilizer + supplemental water) with the design values given in the engineering report (CES, 2001b), and the estimated loads presented in the previous year's ICM Plan.
3. Develop a water budget for each field to include hydraulic loads from the wastewater, supplemental water, and precipitation. Determine the leaching fraction for each field and compare the values to the design leaching requirement; 7.6% or 4.4 inches (CES, 2001b)
4. Develop a salt budget for each field. Salt loadings to each field shall include loads from the wastewater, fertilizer, and supplemental water.
 - a. The report shall determine the need and describe any planned leaching to control soil salinity.
5. Report all crop and soil testing results.
 - a. Present at least a running three year end-of-crop-year soil profile nitrate and salinity graph for each field to show the trend in values.

The monitoring plan submitted by BAF recommends that freshwater flows to the I/C fields be estimated. Ecology does not agree with the estimation of flows to any field and agrees with BAF's farm consultant that meter readings need to be collected to more accurately monitor hydraulic loadings to the non-alfalfa fields (Soiltest, 2005). The sprayfield system represents the wastewater treatment facility for BAF's processing facility and loads based on estimated flows is not sufficient to evaluate its level of treatment and operation relative to its design and the protection of the ground water.

The permit will require the development and implementation of a method to measure the flow of wastewater and supplemental water to every field.

The requirement to describe the total nutrient and water loading to every field is supported by:

1. The authorization of Section S1 of the permit to apply wastewater to all fields "...for final treatment...". All of the fields make up the wastewater treatment system for the BAF facility.
2. The state's water pollution law states it shall be unlawful for any person "...to cause..." pollution of waters of the state; RCW 90.48.080. To insure that BAF is not causing an impact to the ground water beneath the site, the permit requires that all sources of water and nutrients to the site are accounted for and reported.

PETIOLE TESTING

Petiole testing is a technique that chemically analyzes the soluble nutrients in the sap of the leaf stem. It predicts the future growth potential of the plant and provides a “snapshot” of the current state of the soluble nutrient affairs of the plant can guide the farmer in micromanaging the nutrient availability to the plant. If a nutrient is lacking, the farmer can then make decisions on how to correct the deficiency.

The petiole of the plant is a very sensitive indicator of current soil N availability, and management practices such as supplemental N application through irrigation systems (fertigation) allow for corrective measures when deficiencies or excesses are detected.

According to BAF, petiole testing is done weekly by the I/C field farmer to help determine fertilizer applications onto the fields. This fertilization management strategy helps to minimize nitrogen loading to the fields.

The annual ICM Plan will include the following relative to petiole testing:

1. A petiole testing plan will be described for each field for the coming year.
2. The ICM Plan will compare the estimated fertilizer nitrogen requirements for each field, as presented in the previous year’s ICM Plan, to the actual fertilizer nitrogen loads that were applied based on the petiole test results.

OPERATIONS AND MAINTENANCE

The proposed permit contains condition S 5. as authorized under Chapter 173-240-150 WAC and Chapter 173-216-110 WAC. It is included to ensure proper operation and regular maintenance of equipment, and to ensure that adequate safeguards are taken so that constructed facilities are used to their optimum potential in terms of pollutant capture and treatment.

BEST MANAGEMENT PRACTICES

BAF developed and submitted several BMPs to reduce the potential impact to the ground water from the year-around application of its wastewater. These were used to develop a list of BMPs for the permit:

1. A viable and healthy cover crop shall be maintained on all fields that receive wastewater during the winter non-growing season.
2. Annual crops will be followed with deep-rooted alfalfa, wheat, or a perennial crop to maximize the uptake of residual soil nitrate.
3. Adjust irrigation plans during the winter to minimize percolate losses
4. Adjust irrigation plans during high precipitation events to minimize percolate losses.
5. Use irrigation water and/or winter precipitation to meet the leaching requirement.
6. Operate each field so that the three-year running average end-of-crop-year soil profile nitrate concentration is stable or declining.

7. Monitor soil profile water by neutron probe, or equivalent system, on representative fields for each crop, at least weekly.

FLOW MEASUREMENT – I/C FIELDS

From the information available to Ecology, wastewater and freshwater flows to the I/C fields are estimated values. To insure a better determination of the total annual amount of water and nutrients on these fields, the O&M section of the permit will require the installation of some form of flow measurement to each of the I/C fields. This requirement is supported by BAF's consultant that meter readings are needed to more accurately monitor hydraulic loading to the I/C fields (Soiltest; 2005).

YEAR AROUND LAND APPLICATION

Evaluations that have been made on the effectiveness of BAF's year around land treatment system to protect the ground water beneath the site have been based on statistical and modeling analysis using monitoring data collected by BAF. These types of analytical methods can have varying results depending on the accepted level of uncertainty, assumptions made, and data variability and interpretation. This was evident in comparing the results of the WSU technical review and the information presented to Ecology by BAF.

Ecology's recently adopted guidance for land treatment systems (Ecology, 2004) allows for site specific demonstrations of innovative treatment methodologies that depart from what Ecology has approved as AKART. Approval of these methodologies is dependent on their demonstrated ability to equally protect the ground water to what has been previously accepted as AKART for other land treatment systems. A third party review of the available information has raised questions about the level of ground water protection.

The continued operations of the current year around system will depend on the ability of BAF to demonstrate that, using long-term monitoring data and implementing the requirements in this permit, their land treatment site is equally protective of the ground water as that which has been approved by Ecology as AKART. BAF's demonstration will need to be presented in an addendum to the engineering report for the site. However, additional time must be allowed to implement the requirements in this permit that include:

1. Install a vadose zone monitoring system that will collect leachate from the vadose zone and better explain the fate and transport of nitrogen in the root zone during a time of the year when the potential for leaching is high; Spring.
2. Develop and report inclusive nitrogen, salt, and hydraulic load and budget information for each field based on measured flows
3. Implement sprayfield BMPs and determine the affect, if any, on the trend in soil nitrate concentrations and salinity.

It will be determined during the development of the next permit if sufficient information is available to require BAF to submit an engineering report addendum to demonstrate an equivalent level of protection to the ground water as that which has been approved by Ecology to be AKART; i.e., winter storage.

Critical Spring time period

The 2005 technical review report identified the Spring time as a critical period as it related to leaching of nitrates to the ground water. As soil temperatures and moisture increase, denitrification also increases. With the crop demand for nutrients being generally low during the early growing season and wastewater being applied year around the potential for leaching of nitrates and salts to the ground water is high.

It was recommended that the frequency and intensity of soil monitoring during the Spring critical period be increased to better understand "... the dynamic characteristics of nitrogen leaching and nitrification events in spring time..."

It is the intent that the vadose zone monitoring system that is required by the proposed permit will provide information on the quality and quantity of leachate during the critical Spring time period.

Supplemental monitoring

The technical review report (WSU, 2005) could not determine if the nitrates being leached from BAF's sprayfields to the ground water were from the wastewater or commercial fertilizer. A potential way to identify the source of the nitrogen is to use a tracer chemical or parameter. A possible candidate is the use of nitrogen isotopes. Depending on the isotope make-up of each nitrogen source to the ground water (wastewater; fertilizer), the source of the nitrates in the ground water could be found.

Ecology does not have any experience with nitrogen isotope analysis and its application to environmental data analysis. It is recommended that BAF consider this or a similar tracer test procedure in an attempt to determine the source of nitrates and chlorides to the ground water beneath the site.

SOLID WASTE PLAN

A Solid Waste Plan was submitted to Ecology by BAF in March 2001. Approximately 11×10^6 lbs of potato solids are produced annually which is hauled off-site for cattle feed. Dirt washed from the potatoes (approximately 9×10^6 lbs/year) is applied onto adjacent lands.

This proposed permit requires, under authority of RCW 90.48.080, that the Permittee develop and submit to the Department a solid waste plan for all process residual wastes stored or managed on and off the processing site. The plan shall describe all measures associated with containment and disposal that will be implemented to prevent solid waste and leachate from discharging into waters of the state; surface and ground water.

SPILL PLAN

A Spill Plan was submitted to Ecology in March 2001 and details some of the spill prevention measures that have been completed. They include: provide secondary containment for sanitary caustic, oils, and solvents; removed a 20,000 gallon diesel tank; sensing devices have been placed on underground diesel lines; spill kits have been purchased.

The proposed permit requires the Permittee to review and update this plan and submit it to the Department. The most notable update requirement is the phone number for Ecology.

GENERAL CONDITIONS

General Conditions are based directly on state laws and regulations and have been standardized for all industrial waste discharge to ground water permits issued by the Department.

Condition G1 requires responsible officials or their designated representatives to sign submittals to the Department. Condition G2 requires the Permittee to allow the Department to access the treatment system, production facility, and records related to the permit. Condition G3 specifies conditions for modifying, suspending or terminating the permit. Condition G4 requires the Permittee to apply to the Department prior to increasing or varying the discharge from the levels stated in the permit application. Condition G5 requires the Permittee to construct, modify, and operate the permitted facility in accordance with approved engineering documents. Condition G6 prohibits the Permittee from using the permit as a basis for violating any laws, statutes or regulations. Conditions G7 and G8 relate to permit renewal and transfer. Condition G9 requires the payment of permit fees. Condition G10 describes the penalties for violating permit conditions.

RECOMMENDATION FOR PERMIT ISSUANCE

This proposed permit meets all statutory requirements for authorizing a wastewater discharge, including those limitations and conditions believed necessary to control toxics, and to protect human health and the beneficial uses of waters of the State of Washington. The Department proposes that the permit be issued for five years.

REFERENCES FOR TEXT AND APPENDICES

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CES. 2001a. Basic American Foods / Moses Lake, Hydrogeologic Study, Ground Water Quality Evaluation. October.

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Soiltest. 2004. Land Application Annual Report – Crop Year November 2002 through October 2003. April.

Soiltest. 2005. Land Application Annual Report – Crop Year November 2003 through October 2004. April.

Washington State Department of Ecology, 1993. Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems, Ecology Publication # 93-36. 20 pp.

Washington State Department of Ecology.

Laws and Regulations(<http://www.ecy.wa.gov/laws-rules/index.html>)

Permit and Wastewater Related Information

(<http://www.ecy.wa.gov/programs/wq/wastewater/index.html>)

Washington State Department of Ecology, 1996. Implementation Guidance for the Ground Water Quality Standards, Ecology Publication # 96-02.

Washington State Department of Ecology, 2004. Guidance on Land Treatment of Nutrients in Wastewater, with Emphasis on Nitrogen. November. Publication No. 04-10-081.

Washington State University, 2005. Report of Technical Review of Basic American Foods/Moses Lake, Wastewater Land Treatment System. November.

APPENDICES

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

The Department has tentatively determined to reissue a permit to the applicant listed on page one (1) of this fact sheet. The permit contains conditions and effluent limitations which are described in the rest of this fact sheet.

Public notice of application was published on September 12, and 19, 2005 in the Columbia Basin Herald to inform the public that an application had been submitted and to invite comment on the reissuance of this permit.

The Department will publish a Public Notice of Draft (PNOD) on (date) in the Columbia Basin Herald to inform the public that a draft permit and fact sheet are available for review. Interested persons are invited to submit written comments regarding the draft permit. The draft permit, fact sheet, and related documents are available for inspection and copying between the hours of 8:00 a.m. and 5:00 p.m. weekdays, by appointment, at the regional office listed below. Written comments should be mailed to:

Water Quality Permit Coordinator
Department of Ecology
4601 North Monroe Street
Spokane, WA 99205-1295

Any interested party may comment on the draft permit or request a public hearing on this draft permit within the thirty (30) day comment period to the address above. The request for a hearing shall indicate the interest of the party and reasons why the hearing is warranted. The Department will hold a hearing if it determines there is a significant public interest in the draft permit (WAC 173-216-100). Public notice regarding any hearing will be circulated at least thirty (30) days in advance of the hearing. People expressing an interest in this permit will be mailed an individual notice of hearing.

Comments should reference specific text followed by proposed modification or concern when possible. Comments may address technical issues, accuracy and completeness of information, the scope of the facility's proposed coverage, adequacy of environmental protection, permit conditions, or any other concern that would result from issuance of this permit.

The Department will consider all comments received within thirty (30) days from the date of public notice of draft indicated above, in formulating a final determination to issue, revise, or deny the permit. The Department's response to all significant comments is available upon request and will be mailed directly to people expressing an interest in this permit.

Further information may be obtained from the Department by telephone, 509.329.3524, or by writing to the address listed above.

The Fact Sheet and permit were written by Don Nichols.

APPENDIX B--GLOSSARY

Alternate Point of Compliance – May be established at locations some distance from the discharge source, up to, but not exceeding the property boundary and are determined on a site specific basis. An “early warning value” must be used when an alternate point is established. They can only be established by one of four ways as explained in WAC 173-200-060(2).

Ambient Water Quality--The existing environmental condition of the water in a receiving water body.

Background Ground Water Quality – Is statistically defined as the 95 percent upper tolerance interval with a 95% confidence.

Best Management Practices (BMPs)--Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD₅--Determining the Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD₅ is used in modeling to measure the reduction of dissolved oxygen in a receiving water after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Composite Sample--A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite"(collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots.

Continuous Monitoring --Uninterrupted, unless otherwise noted in the permit.

Distribution Uniformity--The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early Warning Value – Is a concentration set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. They can be established in the effluent, ground water, surface water, the vadose zone or within the treatment process.

Enforcement Limit – Is the concentration for an individual contaminant that represents the maximum allowable concentration which can be detected at a specific point of compliance in the ground water.

Engineering Report--A document, signed by a professional licensed engineer, which thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report shall contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Grab Sample--A single sample or measurement taken at a specific time or over a short period of time as is feasible.

Industrial Wastewater--Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

pH--The pH of a liquid measures its acidity or alkalinity. A pH of 7 is defined as neutral, and large variations above or below this value are considered harmful to most aquatic life.

Point of Compliance -- Is the location where the facility must be in compliance with the Ground Water Quality Standards. It is determined on a site specific basis and approved or designated by Ecology. It should be located in the ground water as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible.

Quantitation Level (QL)-- A calculated value five times the MDL (method detection level).

Soil Scientist--An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5,3,or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

State Waters--Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater--That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based Effluent Limit--A permit limit that is based on the ability of a treatment method to reduce the pollutant.

Total Dissolved Solids--That portion of total solids in water or wastewater that passes through a specific filter.

Water Quality-based Effluent Limit--A limit on the concentration of an effluent parameter that is intended to prevent pollution of the receiving water.

APPENDIX C--TECHNICAL CALCULATIONS

ADDENDUM 1:

The upper tolerance limit values (background) for nitrate and TDS in the ground water at the upgradient wells were determined using the Sanitas for Ground Water and Environmental Media v. 8.6 statistical package. The basic steps that were used included:

1. Checked for outliers: all outliers were removed from the data set before any calculations were done.
2. Checked for seasonality: whenever seasonality was found, the data was "de-seasonalized" and the alternate values were then used.
3. Checked for any trend: whenever a trend was detected, the earliest data values were progressively eliminated until there was no significant trend; the remaining database was used for determining the upper tolerance limit.

A graphical presentation of this process and the results for each upgradient well is presented in ADDENDUM 2.

ADDENDUM 3:

1. Linear regression lines for the downgradient wells were determined using EXCEL, and not forcing the line through zero.
2. The Sen's slope estimator values were determined using the Sanitas for Ground Water and Environmental Media v. 8.6 statistical package. All values reported in the DMRs were used.

APPENDIX D--RESPONSE TO COMMENTS

Basic American Foods – Approximate Permit Actions Timeline

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2006		Issue permit		Irrig/Crop Plan			I/C fields flow measurement					Vadose Zone Plan
2007				Irrig/Crop Plan								Sol. BOD testing report
2008				Irrig/Crop Plan								
2009				Irrig/Crop Plan								
2010				Irrig/Crop Plan					Permit App.			
2011				Irrig/Crop Plan								



Moses Lake

Hwy 17

Hwy 90

Hwy 17

Fig. 1. BAF sprayfield site



Patrolers Reservoir



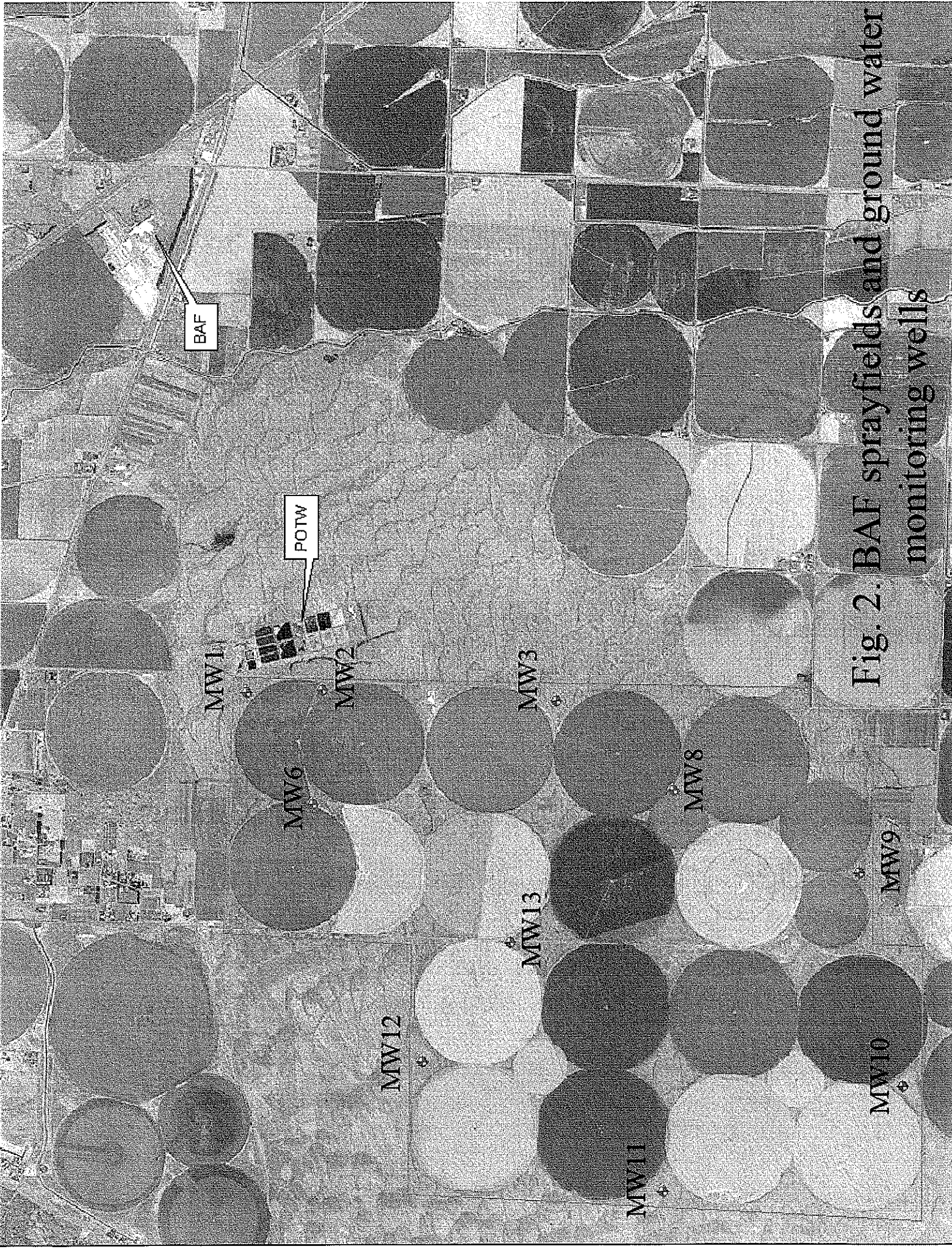
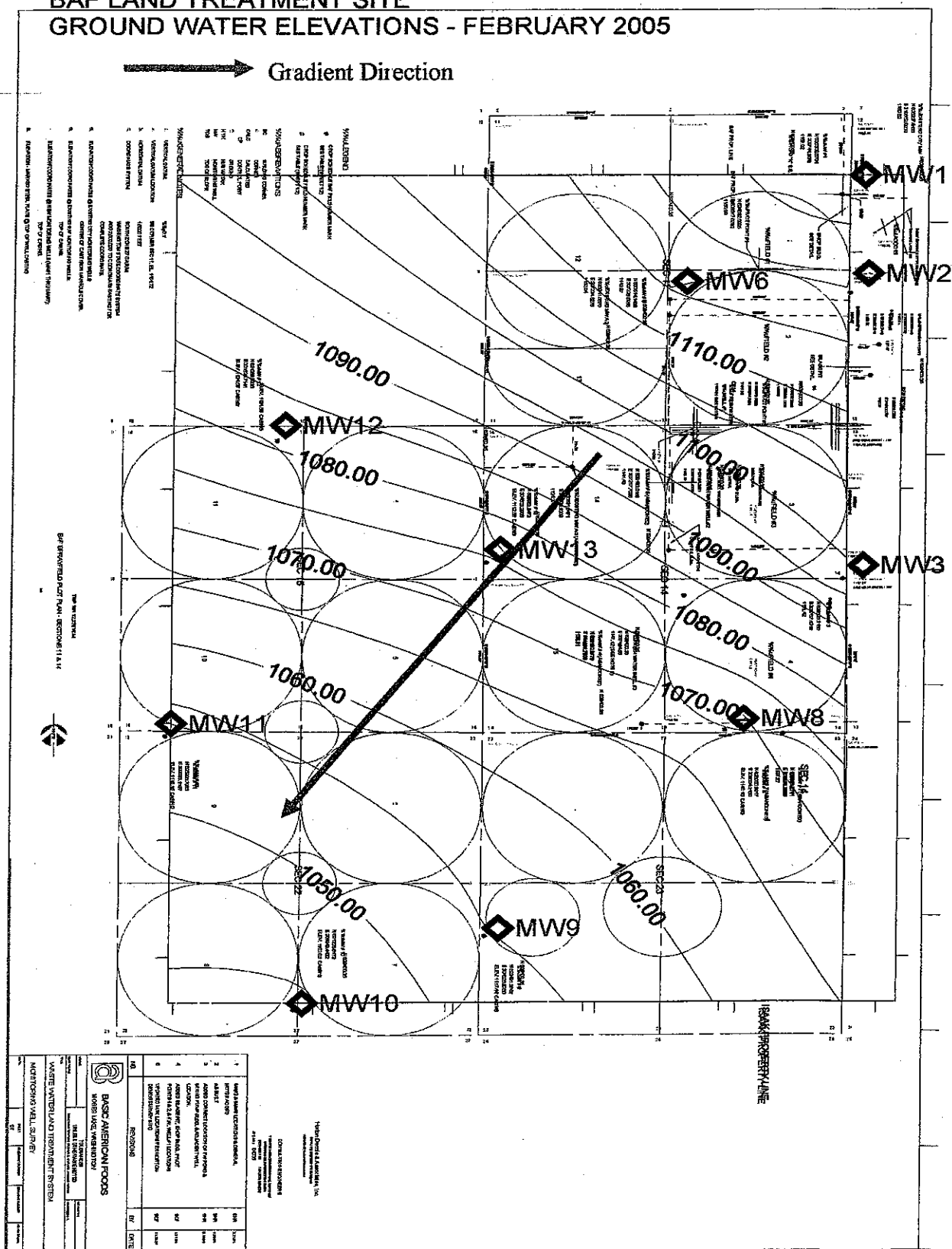


Fig. 2. BAF sprayfields and ground water monitoring wells

BAF LAND TREATMENT SITE
GROUND WATER ELEVATIONS - FEBRUARY 2005



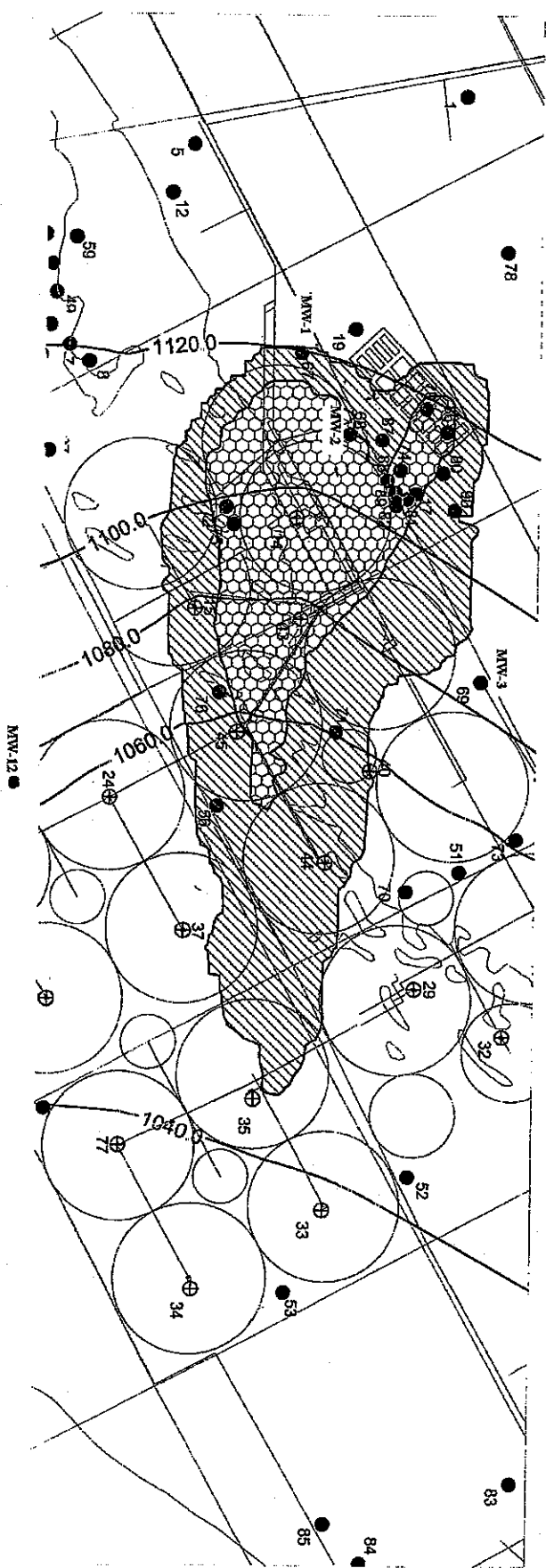
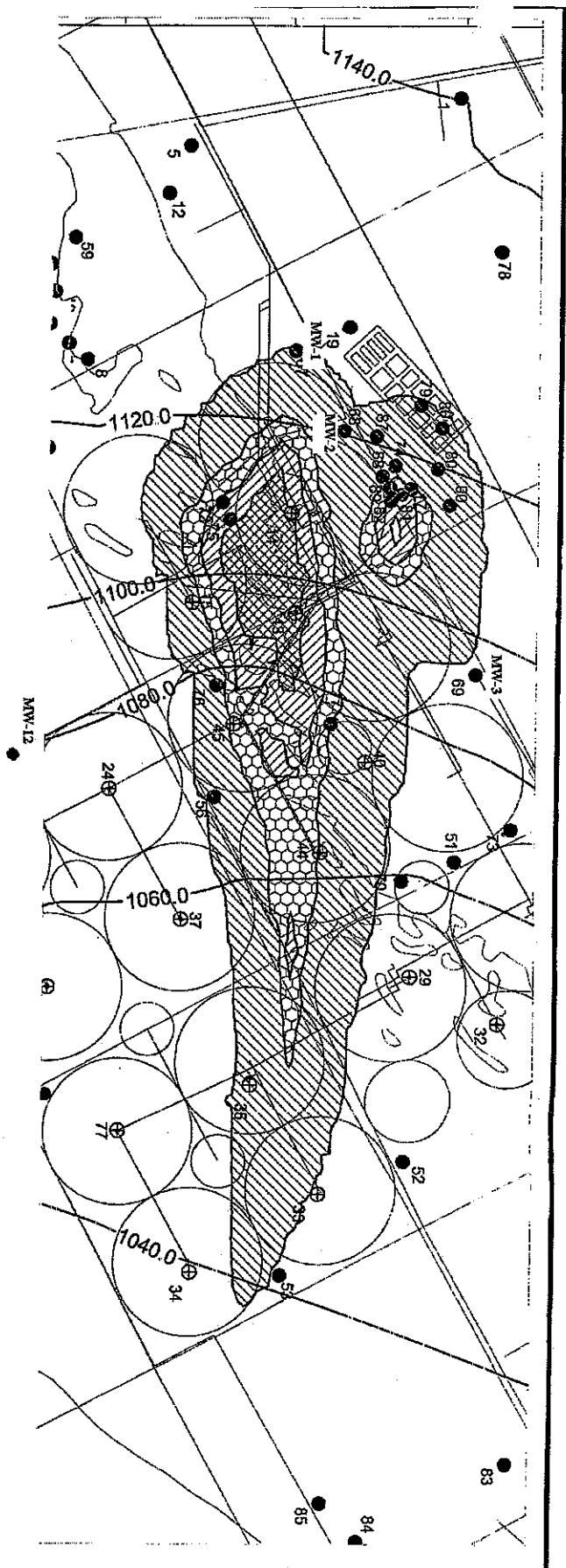


Fig. 4. Modelled BAF summer ground water configuration.

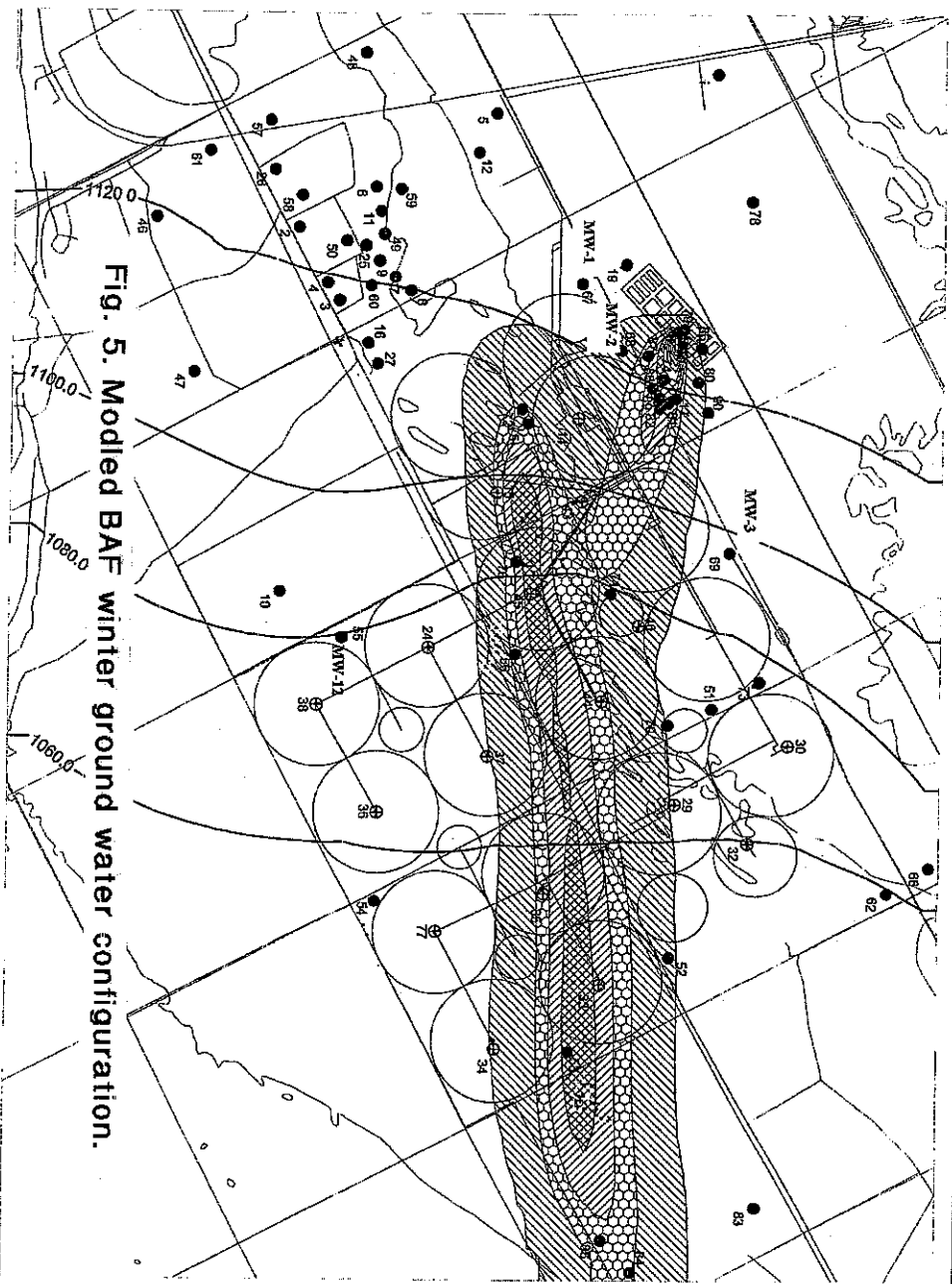
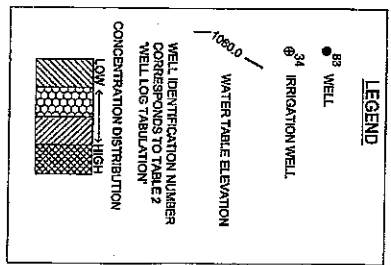


Fig. 5. Modled BAF winter ground water configuration.

WELL LOCATIONS

BAF WELL	MODEL LOCATION NUMBER
WM-1	867
WM-2	868
WM-3	869
WM-4 (ABANDONED)	870
WM-5 (ABANDONED)	871
WM-6 (ABANDONED)	872
WM-7 (ABANDONED)	873
WM-8	874
WM-9	875
WM-10	876
WM-11	877
WM-12	878
WM-13	879
WM-14	880
WM-15	881
WM-16	882
WM-17	883
WM-18	884
WM-19	885
WM-20	886
WM-21	887
WM-22	888
WM-23	889
WM-24	890
WM-25	891
WM-26	892
WM-27	893
WM-28	894
WM-29	895
WM-30	896
WM-31	897
WM-32	898
WM-33	899
WM-34	900
WM-35	901
WM-36	902
WM-37	903
WM-38	904
WM-39	905
WM-40	906
WM-41	907
WM-42	908
WM-43	909
WM-44	910
WM-45	911
WM-46	912
WM-47	913
WM-48	914
WM-49	915
WM-50	916
WM-51	917
WM-52	918
WM-53	919
WM-54	920
WM-55	921
WM-56	922
WM-57	923
WM-58	924
WM-59	925
WM-60	926
WM-61	927
WM-62	928
WM-63	929
WM-64	930
WM-65	931
WM-66	932
WM-67	933
WM-68	934
WM-69	935
WM-70	936
WM-71	937
WM-72	938
WM-73	939
WM-74	940
WM-75	941
WM-76	942
WM-77	943
WM-78	944
WM-79	945
WM-80	946
WM-81	947
WM-82	948
WM-83	949
WM-84	950
WM-85	951
WM-86	952
WM-87	953
WM-88	954
WM-89	955
WM-90	956
WM-91	957
WM-92	958
WM-93	959
WM-94	960
WM-95	961
WM-96	962
WM-97	963
WM-98	964
WM-99	965
WM-100	966



ADDENDUM 1

Upgradient well data (Jan 2001 – May 2005)

BASIC AMERICAN FOODS
MW-1 - Monthly Sampling

	Water Elev. Feet	Ammonia (as N)		IKN (as N)		NITRATE (as N)		pH	IDS	Temp
		Single MG/L	QLF	Single MG/L	QLF	Single MG/L	QLF	Single S.U.	Single MG/L	Single °F
Jan-01	1134.11	0.5	F	1.5	F	2.1		7.8	199	57.2
Feb-01	1133.37	0.5	F	1.5	F	1.9		7.9	217	57.7
Mar-01	1131.7	0.5	F	0.5	F	2.2		8.4	205	58.8
Apr-01	1122.32	0.5	F	1.5	F	1.8		7.7	213	58.6
May-01	1130.95	0.5	F	1.5	F	1.5		8	218	60.1
Jun-01	1130.55	0.5	F	1.5	F	2.2		8.1	213	60.6
Jul-01	1130.15	0.5	F	1.5	F	2.8		7.6	193	61.3
Aug-01	1130.29	0.6		1.5	F	2.8		9.3	203	60.1
Sep-01	1130.95	0.5		1.5	F	2.9		8.5	206	59.7
Oct-01	1131.57	0.5	F	1.5	F	2.2		7.6	207	59
Nov-01	1132.2	0.5	F	3.9		1.8		8.2	208	59
Dec-01	1132.34	0.5	F	1.5	F	2.1		7.9	198	57.9
Jan-02	1132	0.5	F	2		2		8.1	205	57.6
Feb-02	1131.05	0.8		1.5	F	2.1		7.5	205	58.3
Mar-02	1131.31	0.5	F	1.5	F	2		8.3	212	59.2
Apr-02	1127.48	0.5	F	1.5	F	2.2		8	207	59.4
May-02	1128.09	0.5	F	1.5	F	2.2		7.3	222	60.1
Jun-02	1129.98	0.5	F	1.5	F	1.9		7.9	209	61.5
Jul-02	1129.41	0.5	F	1.5	F	2		8	183	60.1
Aug-02	1129.63	0.5	F	1.5	F	1.9		8.1	219	60.6
Sep-02	1129.36	0.5	F	1.5	F	1.5		8.1	199	60.1
Oct-02	1131.3	0.5	F	1.5	F	1.3		8.1	195	59.4
Nov-02	1131.15	0.5	F	1.5	F	1.6		8.1	177	58.5
Dec-02	1130.35	0.5	F	1.5	F	1.5		8.1	188	58.8
Jan-03	1132.78	0.5		1.5	F	1.8		8	196	58.6
Feb-03	1130.85	0.5	F	1.5	F	1.8		7.3	195	59.4
Mar-03	1130.4	0.6		1.5	F	1.7		7.5	206	59.4
Apr-03	1129.95	0.5	F	1.5	F	2		7.8	206	59.7
May-03	1129.48	0.5	F	1.5	F	1.9		7.8	221	60.3
Jun-03	1129.35	1.6		1.5	F	2.8		7.9	209	61.5
Jul-03	1129.35	0.6		1.5	F	2.8		7.9	236	60.1
Aug-03	1129.66	0.5	F	1.5	F	2.5		7.9	202	59.9
Sep-03	1130.65	0.6		1.5	F	2.1		7.8	209	61.3
Oct-03	1132	0.5	F	1.5	F	1.4		7.8	195	58.3
Nov-03	1132.15	0.5	F	1.5	F	1		7.7	188	58.8
Dec-03	1127.2	0.5	F	1.5	F	1.2		7.3	188	58.6
Jan-04	1132.02	0.5	F	1.5	F	1.3		7.8	190	58.6
Feb-04	1130.91	0.5	F	1.5	F	1.2		7.6	188	58.3
Mar-04	1130.62	0.5	F	1.5	F	1.4		7.7	202	59.5
Apr-04	1130.45	0.5	F	1.5	F	1.7		7.9	193	59.2
May-04	1129.79	0.5	F	2		2.2		7.9	200	59.5
Jun-04	1129.37	0.5	F	1.5	F	1.6		7.9	187	60.3
Jul-04	1129.34	0.5	F	1.5	F	1.8		8.1	212	60.1
Aug-04	1129.2	0.5	F	1.5	F	1.8		8	191	60.6
Sep-04	1129.42	0.5	F	1.5	F	1.6		7.7	196	59.7
Oct-04	1130.12	0.5	F	1.5	F	1.2		7.9	196	61.7
Nov-04	1131.44	0.5	F	1.5	F	1.1		7.8	175	58.5
Dec-04	1130.82	0.5	F	1.5	F	1.4		7.8	171	57.7
Jan-05	1130.4	0.5	F	1.5	F	1.6		7.6	184	57.9
Feb-05	1130.11	0.5	F	1.5	F	1.7		7.9	183	59.2
Mar-05	1129.68	0.5	F	1.5	F	1.6		7.8	201	60.3
Apr-05	1129.31	0.5	F	1.5	F	1.6		8	197	59.9
May-05	1129.19	0.4		1.5	F	1.6		7.9	199	60.3

Average

1.85

200

Qualifiers

F = less than

BASIC AMERICAN FOODS
MW-2 - Monthly Sampling

	Water Elev Feet	Ammonia (as N)		TKN (as N)		NITRATE (as N)		pH Single S.U.	IDS		Temp Single °F
		Single MG/L	QLF	Single MG/L	QLF	Single MG/L			Single MG/L	QLF	
Jan-01	1122 09	0.7		1.5	F	8.6		7.4	647		58.1
Feb-01	1120 64	0.5		1.5	F	9.8		7.5	662		58.1
Mar-01	1121 27	0.5	F	1.5	F	13.2		7.9	654		59
Apr-01	1121 78	0.5	F	1.5	F	22.2		7.3	1389		59
May-01	1119 85	0.5	F	1.5	F	20.5		7.5	709		60.6
Jun-01	1111 64		L		L		L	L		L	L
Jul-01	L		L		L		L	L		L	L
Aug-01	1111 13		L		L		L	L		L	L
Sep-01	1112 57		L		L		L	L		L	L
Oct-01	1113 65	0.5	F	1.5	F	13.7		7.1	692		61.2
Nov-01	1117 65	0.5	F	1.5	F	12.9		7.7	697		60.6
Dec-01	1119 35	0.8		1.9		19		7.3	706		59.5
Jan-02	1120.55	0.5	F	1.5	F	16.9		8.3	712		59.9
Feb-02	1122.3	0.5	F	1.5	F	17.3		7	707		59
Mar-02	1121 95	0.5	F	1.5	F	19.1		8.1	717		60.3
Apr-02	1112.27	0.5	F	1.5	F	18.5		7.6	695		60.4
May-02	1114.7	0.5	F	1.5	F	16.3		7.6	683		60.8
Jun-02	1114 04	0.5	F	1.5	F	17		7.9	717		63
Jul-02	L		L		L		L	L		L	L
Aug-02	L		L		L		L	L		L	L
Sep-02	L		L		L		L	L		L	L
Oct-02	113.45		L		L		L	L		L	L
Nov-02	1115 43		L		L		L	L		L	L
Dec-02	1119 15	0.5		1.5	F	23.1		7.6	708		59.7
Jan-03	1118 58	0.5	F	1.5	F	20.7		7.6	692		59.4
Feb-03	1121	0.5	F	1.8		20.3		7.9	674		59.7
Mar-03	1119 41	0.5	F	1.5	F	14.2		7.4	653		59.9
Apr-03	1119 28	0.5	F	1.5	F	13		7.5	683		61
May-03	1114 95	0.5	F	1.5	F	11.7		7.6	683		61
Jun-03	1112 65		L		L		L	L		L	L
Jul-03	1111 64		L		L		L	L		L	L
Aug-03	1110 67		L		L		L	L		L	L
Sep-03	1160 25		L		L		L	L		L	L
Oct-03	1116 05	0.5	F	4		12.4		7.5	653		59.7
Nov-03	1113		L		L		L	L		L	L
Dec-03	1114.04		L		L		L	L		L	L
Jan-04	1112.7		L		L		L	L		L	L
Feb-04	1112 94		L		L		L	L		L	L
Mar-04	1120 87	0.5	F	1.5	F	12.3		7.5	650		59.5
Apr-04	1114 63	0.5	F	1.5	F	10.5		7.7	625		59.5
May-04	1111 05		L		L		L	L		L	L
Jun-04	L		L		L		L	L		L	L
Jul-04	L		L		L		L	L		L	L
Aug-04	L		L		L		L	L		L	L
Sep-04	L		L		L		L	L		L	L
Oct-04	1114 65	0.5	F	1.5	F	8.6		7.7	662		62.4
Nov-04	1117 96	0.9		1.5	F	9.4		7.7	637		58.8
Dec-04	1119 46	0.5	F	1.5	F	10.7		7.5	622		58.8
Jan-05	1120.58	0.5	F	1.5	F	10.5		7.6	623		59
Feb-05	1119.6	0.5	F	1.5	F	10.3		7.5	609		59.9
Mar-05	1118 44	0.5	F	1.5	F	10.2		7.5	618		60.3
Apr-05	1116.06	0.5	F	1.5	F	9.3		7.6	619		60.1
May-05	1110 46		L		L		L	L		L	L

Average

14.4

693

Qualifiers L = empty well

BASIC AMERICAN FOODS

MW-3 - Monthly Sampling

	Water Elev Feet	Ammonia (as N)		TKN (as N)		NITRAIE (as N)		pH Single S.U.	IDS		Temp Single °F
		Single MG/L	QLF	Single MG/L	QLF	Single MG/L	QLF		Single MG/L	QLF	
Jan-01	1105.44	0.5	F	1.5	F	2.5		7.8	572		57
Feb-01	1106.27	0.5	F	1.5	F	3.3		7.8	569		57
Mar-01	1106.96	0.5	F	1.5	F	5.4		7.8	582		56.1
Apr-01	1107.07	0.5	F	1.5	F	5.1		7.6	591		58.1
May-01	1106.91	0.5	F	1.5	F	4		7.9	595		58.6
Jun-01	1104.91	0.5	F	1.5	F	2.5		8	564		59.4
Jul-01	1101.36		L		L		L	L		L	L
Aug-01	1099.41		L		L		L	L		L	L
Sep-01	1097.96		L		L		L	L		L	L
Oct-01	L		L		L		L	L		L	L
Nov-01	1098.86		L		L		L	L		L	L
Dec-01	1100.81		L		L		L	L		L	L
Jan-02	1100.01	0.5	F	1.5	F	2.8		8.6	529		51.8
Feb-02	1103.26	0.6		1.5	F	3		7.5	507		57
Mar-02	L		L		L		L	L		L	L
Apr-02	1098.31	0.5	F	1.5	F	4.5		8	563		58.6
May-02	1103.86	0.5	F	1.5	F	6.3		7.9	552		59.2
Jun-02	1101.78	0.5		1.5	F	6		8	562		62.2
Jul-02	1098.84		L		L		L	L		L	L
Aug-02	1097.31		L		L		L	L		L	L
Sep-02	L		L		L		L	L		L	L
Oct-02	L		L		L		L	L		L	L
Nov-02	L		L		L		L	L		L	L
Dec-02	1098.04		L		L		L	L		L	L
Jan-03	1099.68		L		L		L	L		L	L
Feb-03	1101.06	0.5		2.6		5.6		7.7	548		57.2
Mar-03	1100.18	0.8		2.1		5.5		7.8	541		58.5
Apr-03	1100.25	0.9		1.5	F	5.1		8	579		62.4
May-03	1100.21	0.7		1.5	F	5.2		7	572		59.4
Jun-03	1099.56		L		L		L	L		L	L
Jul-03	1098.36		L		L		L	L		L	L
Aug-03	1097.29		L		L		L	L		L	L
Sep-03	1153.71		L		L		L	L		L	L
Oct-03	1153.71		L		L		L	L		L	L
Nov-03	1099.9		L		L		L	L		L	L
Dec-03	1098.36		L		L		L	L		L	L
Jan-04	1098.94		L		L		L	L		L	L
Feb-04	1098.47		L		L		L	L		L	L
Mar-04	1100.65		L		L		L	L		L	L
Apr-04	1100.43	0.5	F	1.5	F	4.7		7.9	541		57.9
May-04	1099.7		L		L		L	L		L	L
Jun-04	1098.37		L		L		L	L		L	L
Jul-04	L		L		L		L	L		L	L
Aug-04	L		L		L		L	L		L	L
Sep-04	L		L		L		L	L		L	L
Oct-04	L		L		L		L	L		L	L
Nov-04	L		L		L		L	L		L	L
Dec-04	L		L		L		L	L		L	L
Jan-05	1098.55		L		L		L	L		L	L
Feb-05	1099.5		L		L		L	L		L	L
Mar-05	1100.41	0.5	F	4.3		4.7		8	528		61
Apr-05	1100.03	0.5	F	1.5	F	4.6		8	521		59.5
May-05	1099.56	0.6		1.5	F	4.6		8.3	544		63.5
Average						4.5			556		

Qualifiers L = empty well

BASIC AMERICAN FOODS
MW-12 - Monthly Sampling

	Water Elev Feet	Ammonia (as N)		IKN (as N)		NITRAIE (as N)		pH	IDS	Temp
		Single MG/L	QLF	Single MG/L	QLF	Single MG/L	QLF	Single S.U.	Single MG/L	Single °F
Jan-01	1082.84	0.5	F	1.5	F	7.9		7.6	480	54.7
Feb-01	1082.73	0.5	F	2.2		7.4		8	474	54.1
Mar-01	1082.77	0.5	F	1.5	F	6.8		7.1	454	55.4
Apr-01	1082.66	0.5	F	1.6		6.6		6.8	434	56.8
May-01	1082.46	0.5	F	1.5	F	6.4		8.1	407	59.2
Jun-01	1081.53	0.5	F	1.5	F	7.1		8	438	59.2
Jul-01	1080.86	0.5		2.2		7.3		7.5	428	59.2
Aug-01	1080.45	0.5	F	1.5	F	8.5		9	440	59.9
Sep-01	1080.42	1		1.5	F	7		7.8	437	58.3
Oct-01	1081.08	0.5	F	1.5	F	7.2		7.9	433	57
Nov-01	1081.95	0.5	F	1.5	F	7		8.3	424	56.3
Dec-01	1082.58	0.5	F	1.5	F	6.7		8	409	56.3
Jan-02	1082.58	0.5	F	1.5	F	6.4		8	457	56.7
Feb-02	1082.78	0.5	F	2		7.3		6.6	439	57
Mar-02	1082.67	0.5	F	1.5	F	7.3		6.8	452	59.7
Apr-02	1082.43	0.5	F	1.5	F	6.8		7.9	435	57.9
May-02	1081.27	0.5	F	1.5	F	7.2		7	429	58.1
Jun-02	1081.42	0.5	F	1.5	F	7.2		8	435	58.6
Jul-02	1080.58	0.5	F	1.5	F	6.6		7.8	407	61.2
Aug-02	1066.09	0.5	F	1.5	F	6.9		8	448	59.9
Sep-02	1080.41	0.5	F	1.5	F	7		7.8	432	58.5
Oct-02	1076		L		L		L	L	L	L
Nov-02	1081.56	0.5	F	1.5	F	6.8		7.8	415	56.8
Dec-02	1083.03	0.5	F	4.5	F	6.8		7.8	415	56.8
Jan-03	1083.3	0.5	F	1.5	F	6.4		7.8	415	56.5
Feb-03	1082.58	0.5	F	1.5	F	6.2		7.8	415	57.2
Mar-03	1082.58	0.5	F	2.1		6.2		7.8	403	57.9
Apr-03	1082.58	0.5	F	1.5	F	6.1		7.8	428	58.6
May-03	1082.32	0.5	F	1.5	F	6.1		7.9	422	58.6
Jun-03	1081.79	0.9		1.5	F	6.5		7.9	401	60.8
Jul-03	1080.77	0.5	F	1.5	F	6.9		8	461	62.8
Aug-03	1080.21	6.3		1.5	F	1.1		7.9	398	60.6
Sep-03	1079.98	0.6		1.5	F	7.7		8	403	59.9
Oct-03	1081.08	0.5	F	1.5	F	7.5		7.1	403	55.6
Nov-03	1081.75	0.9		1.5	F	6.9		8	388	56.8
Dec-03	1082.13	0.5	F	1.5	F	6.8		7.9	386	56.1
Jan-04	1082.45	0.5	F	1.5	F	6.7		7.9	387	56.8
Feb-04	1082.64	0.5	F	1.5	F	6.8		7.9	393	56.7
Mar-04	1082.53	0.5	F	1.5	F	6.9		7.9	400	58.3
Apr-04	1082.11	0.5	F	1.5	F	7		7.9	403	57.9
May-04	1081.91	0.5	F	1.5	F	7.3		8	399	58.3
Jun-04	1081.44	0.5	F	1.5	F	7.1		8	388	59.2
Jul-04	1080.83	0.5	F	1.5	F	7.1		8	407	59
Aug-04	1080.53	0.5	F	1.5	F	7.7		8.1	396	59.9
Sep-04	1080.36	0.5	F	1.5	F	7.2		7.9	409	59.9
Oct-04	1081.15	0.5	F	1.5	F	7		7.8	371	61
Nov-04	1081.82	0.5	F	1.5	F	7.5		7.8	381	57.2
Dec-04	1082.27	0.5	F	1.5	F	6.7		7.9	384	56.1
Jan-05	1082.49	0.5	F	1.5	F	6.9		7.9	374	56.8
Feb-05	1082.57	0.5	F	1.5	F	7.5		7.5	385	56.5
Mar-05	1082.48	0.5	F	1.5	F	7		7.9	394	58.1
Apr-05	1082.34	1.7		1.5	F	7.2		7.9	396	57.4
May-05	1080.78	0.3		1.5	F	7.4		8	412	59.2
Average						6.9			416	

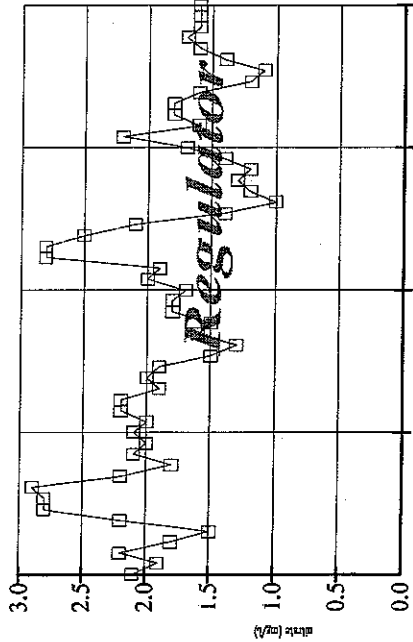
Qualifiers L = empty well

ADDENDUM 2

Background Ground Water Analysis

Nitrate

OUTLIER ANALYSIS MW1

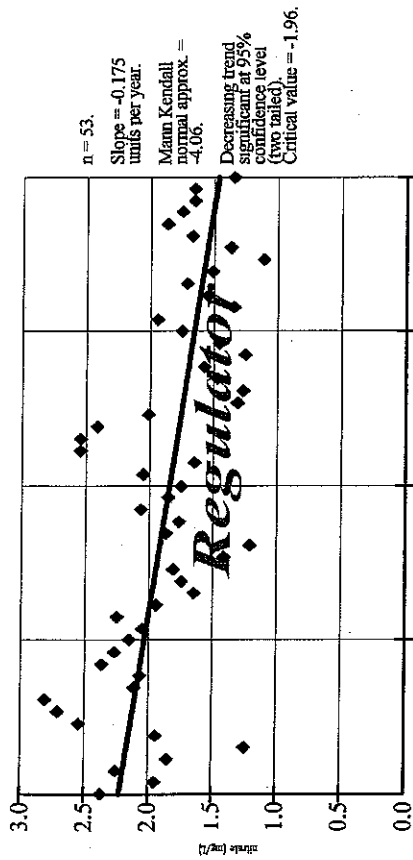


Log-transformed:
Mean = 0.5838
Std. Dev. = 0.248
Critical Tn = 2.978
No statistical outliers
Data were found to be
normally distributed.
Normality test used:
Shapiro-Francia
W Statistic = 0.9602
W Quantile = 0.957

Jan 2001 Mar 2003 May 2005

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 2:52 PM Client: Regulatory Use View: BAF-MW1(01-05)

SEN'S SLOPE ESTIMATOR (Alt. Values) MW1



n = 53
Slope = -0.175
units per year.
Mann Kendall
normal approx. =
-4.06
Decreasing trend
significant at 95%
confidence level
(two tailed).
Critical value = -1.96.

Jan 2001 Mar 2003 May 2005

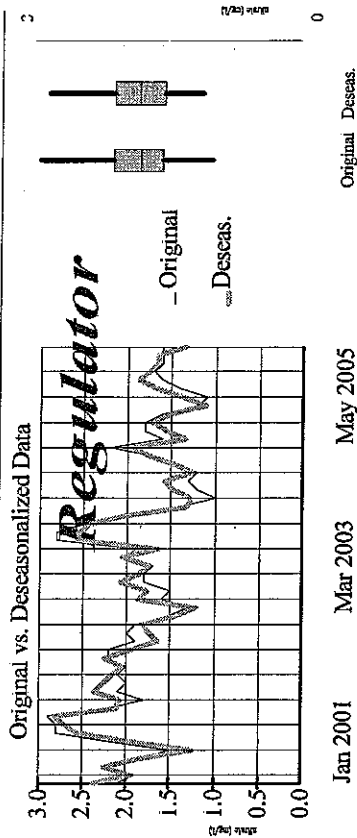
Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 2:55 PM Client: Regulatory Use View: BAF-MW1(01-05)

SEASONALITY: MW1

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration of this constituent than any other season.

Calculated Kruskal-Wallis statistic = 8.012
Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.
There were 12 groups of data.
The adjusted Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H) was utilized to determine if the medians were equal.

Kruskal-Wallis statistic (H) = 7.952
Adjusted Kruskal-Wallis statistic (H) = 8.012

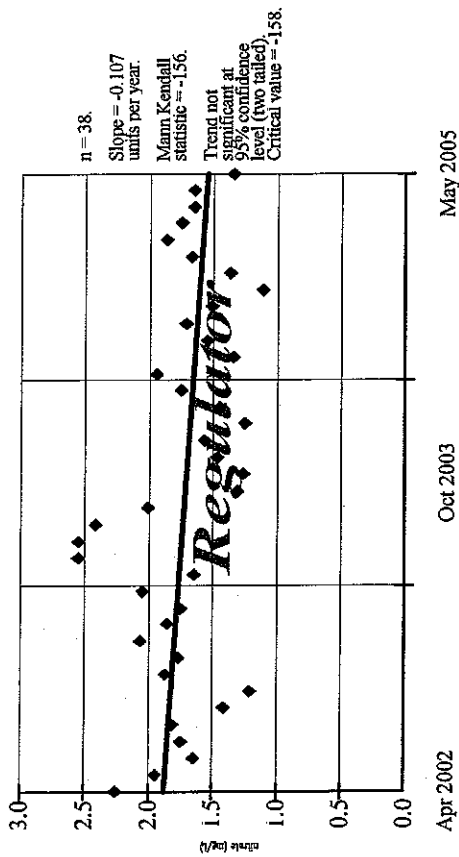


Jan 2001 Mar 2003 May 2005 Original Descas.

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 2:52 PM Client: Regulatory Use View: BAF-MW1(01-05)

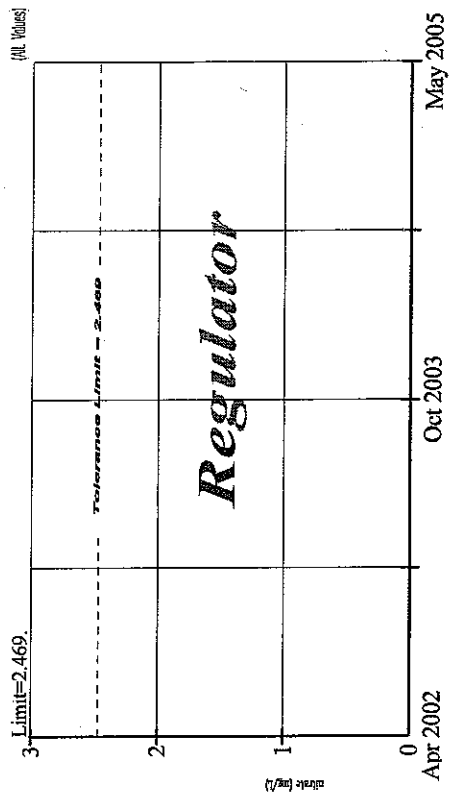
Elim Jan 01 - Mar 02 to get
no signif decr. trend → next
page

SEN'S SLOPE ESTIMATOR (Alt. Values) MW1



Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:00 PM Client: Regulatory Use View: BAF-MW1(01-05)

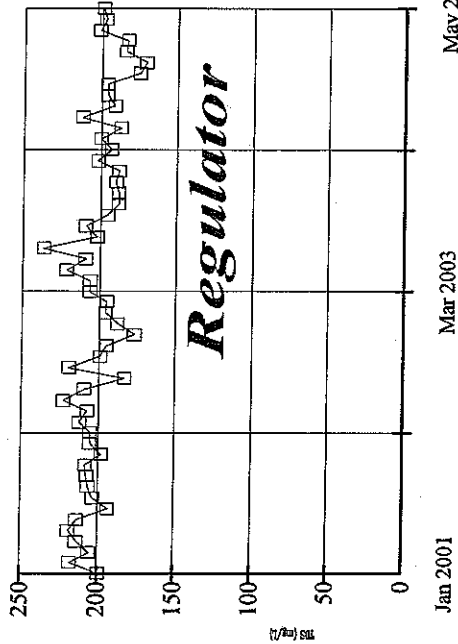
PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW1



95% coverage. Background Data Summary: Mean=1.715, Std.Dev=0.3521, 0% nbs, 38 obs. Normality test used: Shapiro Wilk.
Statistic for background data = 0.9321, W Quantile = 0.938, Testwise alpha = 0.05.

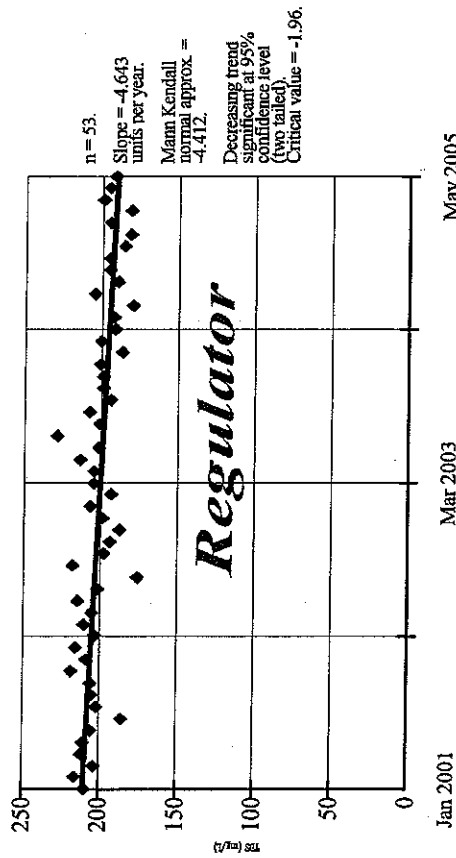
Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:02 PM Client: Regulatory Use View: BAF-MW1(01-05)

OUTLIER ANALYSIS (~~Alt. Values~~) MW1



Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:13 PM Client: Regulatory Use View: BAF-MW1(01-05)

SEN'S SLOPE ESTIMATOR (Alt. Values) MW1



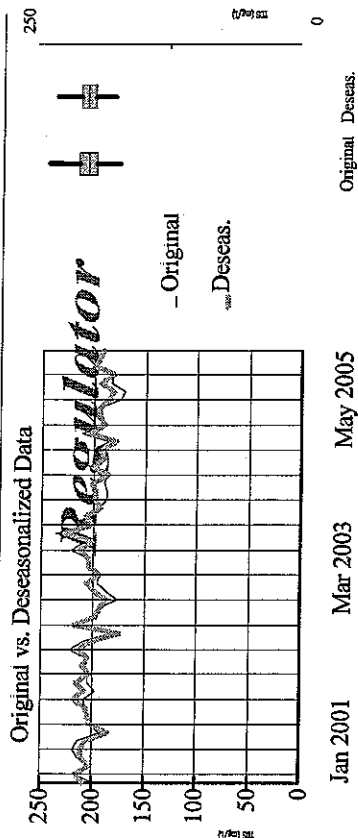
Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:15 PM Client: Regulatory Use View: BAF-MW1(01-05)

SEASONALITY: MW1 (Alt. Values)

For the data shown, the Kruskal-Wallis test indicates SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one season has a significantly different median concentration than the other seasons.

Calculated Kruskal-Wallis statistic = 12.144
Tabulated Chi-Squared value for 3 degrees of freedom at the 5% significance level = 7.815
There were 13 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the means were equal.

Kruskal-Wallis statistic (H) = 12.124
Adjusted Kruskal-Wallis statistic (H') = 12.144

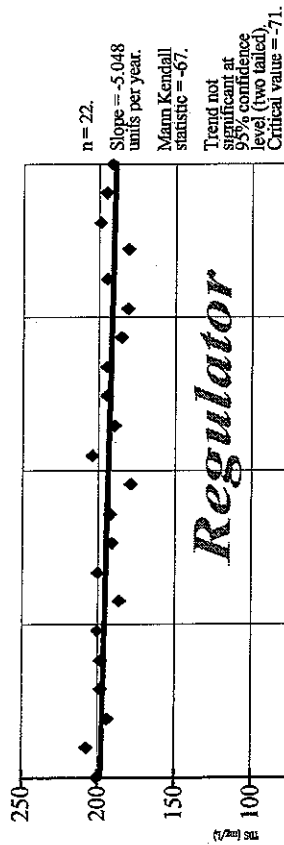


Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:14 PM Client: Regulatory Use View: BAF-MW1(01-05)

Elim Jan 01 - July 03 to get
no signif decrease trend

next page

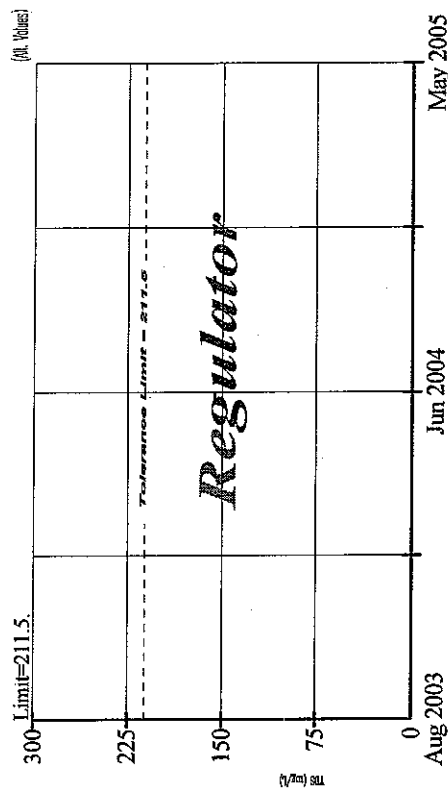
SEN'S SLOPE ESTIMATOR (Alt. Values) MW1



Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:21 PM Client: Regulatory Use View: BAF-MW1(01-05)

PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW1

TDS

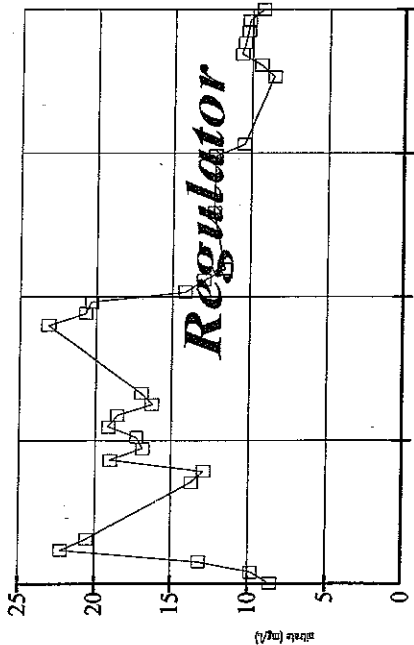


95% coverage. Background Data Summary: Mean=193.8, Std. Dev.=7.526, 0% nds, 22 obs. Normality test used: Shapiro Wilk. A for background data = 0.9681, W Quantile = 0.911. Testwise alpha = 0.05.

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW1(01-05)
Date: 8/30/05, 3:22 PM Client: Regulatory Use View: BAF-MW1(01-05)

Nitrate

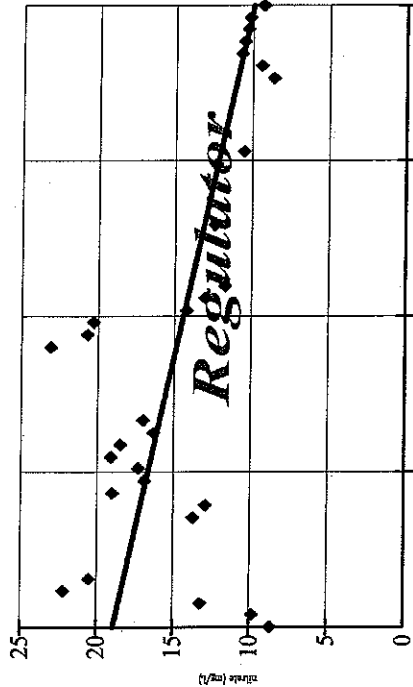
OUTLIER ANALYSIS MW2



⇒

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:01 AM Client: Regulatory Use View: BAF-MW2(01-05)

SEN'S SLOPE ESTIMATOR MW2



Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:04 AM Client: Regulatory Use View: BAF-MW2(01-05)

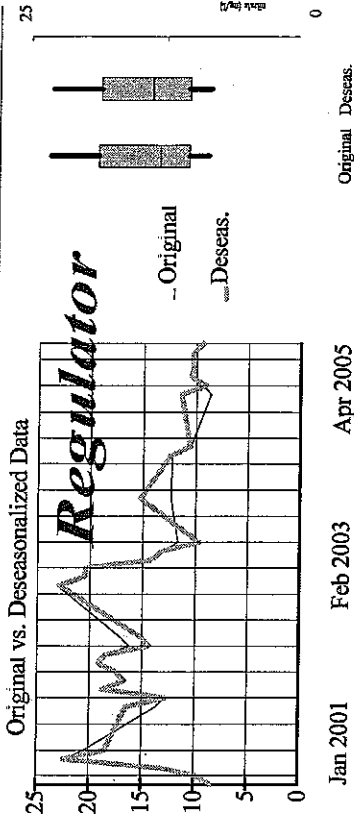
SEASONALITY: MW2

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.

Calculated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

The overall mean of the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was 1.797.

Adjusted Kruskal-Wallis statistic (H') = 1.797

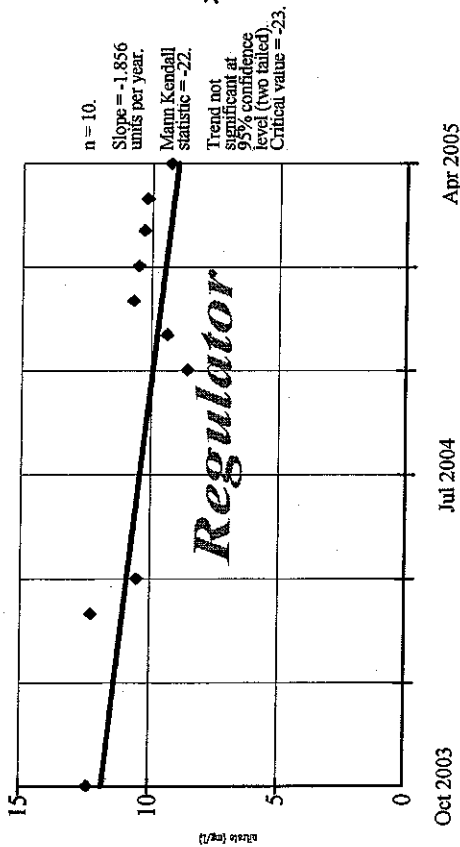


Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:03 AM Client: Regulatory Use View: BAF-MW2(01-05)

⇒ Eliminate Jan 01 - May 03
to get no significant trend →

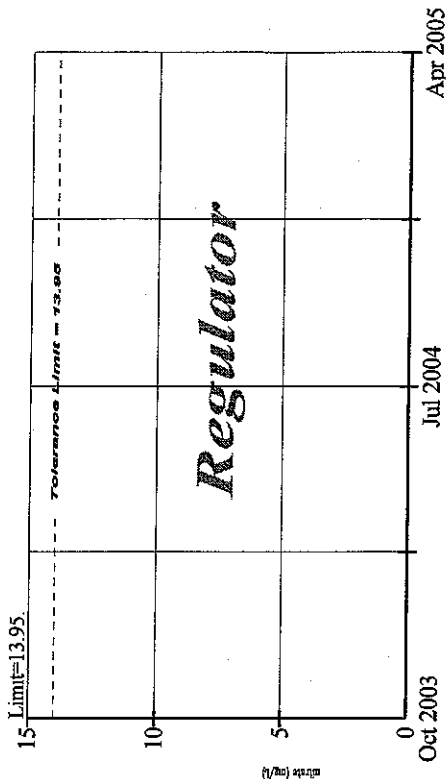
NO3

SEN'S SLOPE ESTIMATOR MW2



Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:08 AM Client: Regulatory Use View: BAF-MW2(01-05)

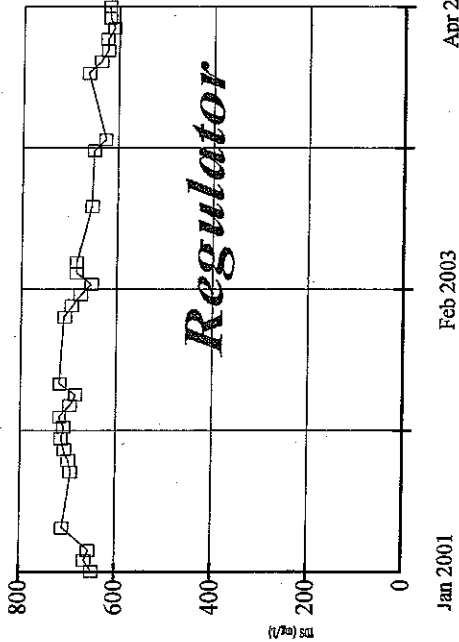
PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW2



95% coverage, Background Data Summary: Mean=10.42, Std. Dev.=1.212, 0% nbs, 10 obs. Normality test used: Shapiro Wilk. λ for background data = 0.9222, W Quantile = 0.842, Testwise alpha = 0.05.

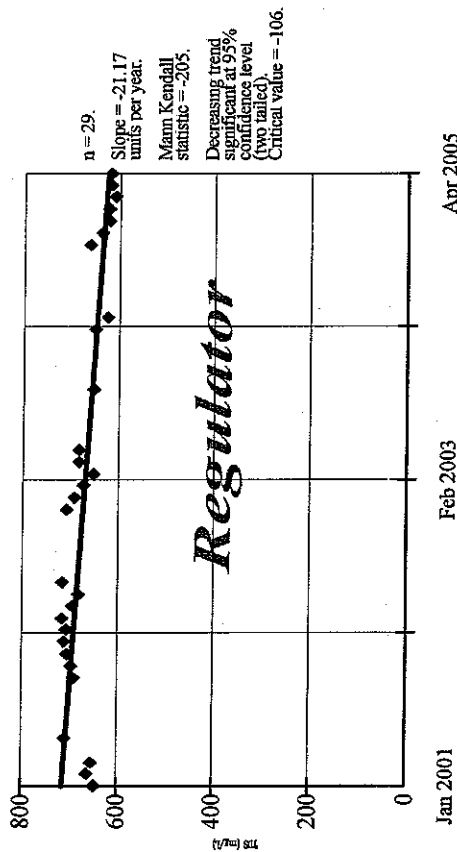
Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:08 AM Client: Regulatory Use View: BAF-MW2(01-05)

OUTLIER ANALYSIS MW2



7

SEN'S SLOPE ESTIMATOR MW2



TDS

SEASONALITY: MW2

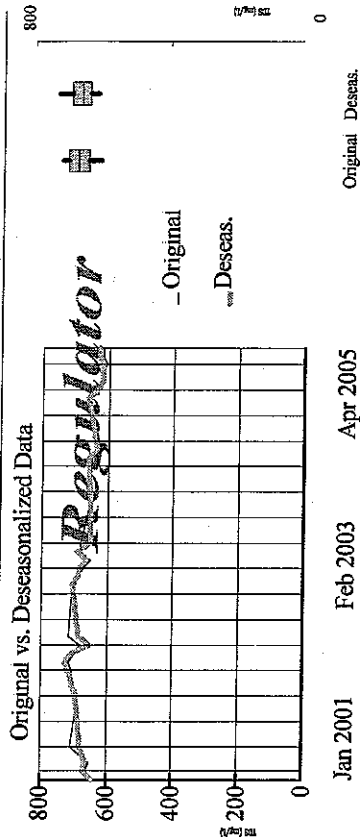
For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other.

Calculated Kruskal-Wallis statistic = 3.986

Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

There were 5 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') is 3.978.

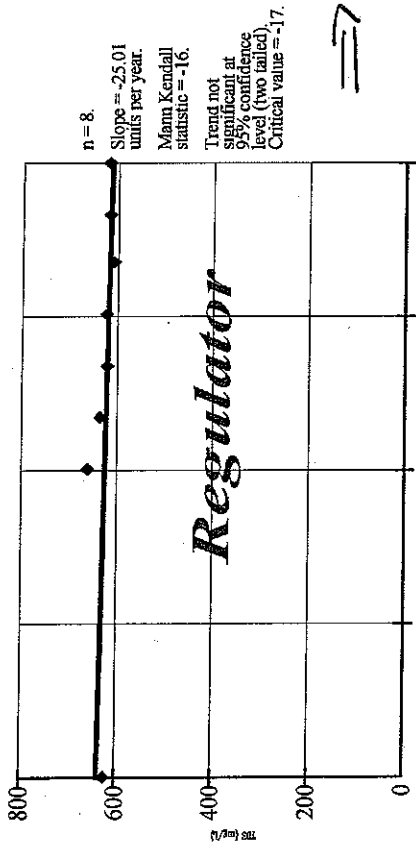
Adjusted Kruskal-Wallis statistic (H') = 3.986



Eliminate Jan 01 - Mar 04
to get no signif trend

TDS

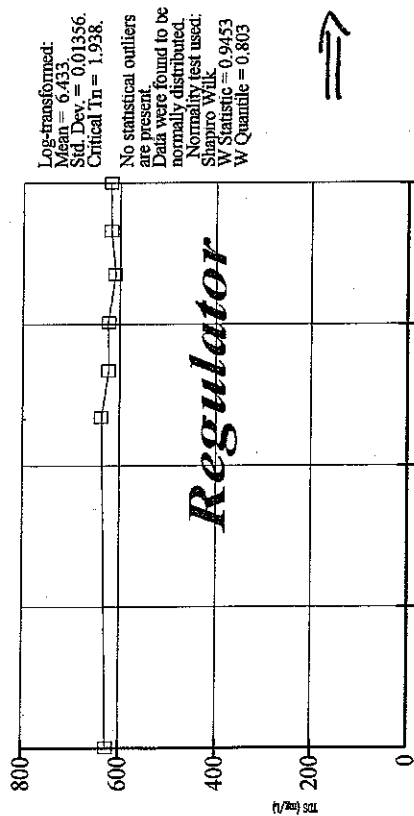
SEN'S SLOPE ESTIMATOR MW2



⇒

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:22 AM Client: Regulatory Use View: BAF-MW2(01-05)

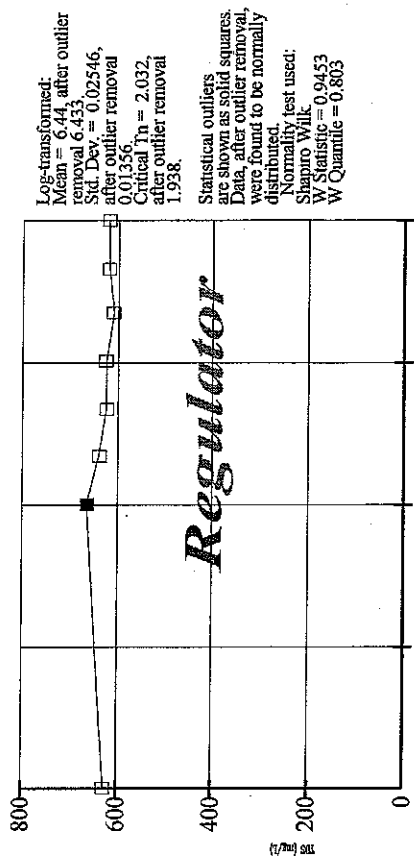
OUTLIER ANALYSIS MW2



⇒

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:22 AM Client: Regulatory Use View: BAF-MW2(01-05)

OUTLIER ANALYSIS MW2

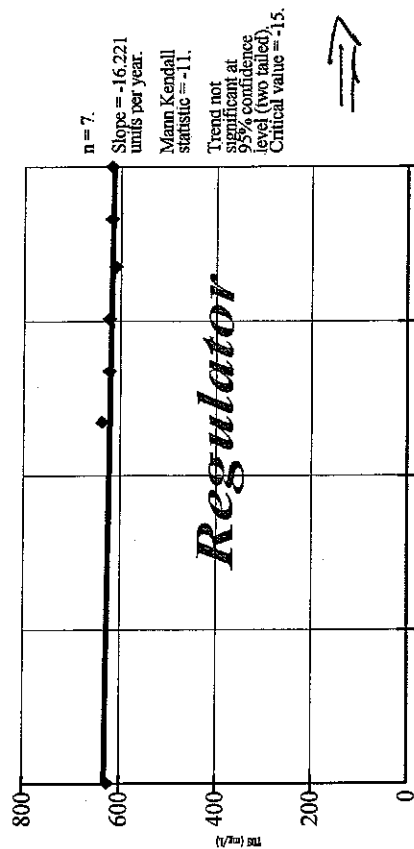


⇒

Apr 2004 Oct 2004 Apr 2005
Note: EPA guidance directs that statistical outliers should not be removed or altered unless independent evidence of an error exists.

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:22 AM Client: Regulatory Use View: BAF-MW2(01-05)

SEN'S SLOPE ESTIMATOR MW2



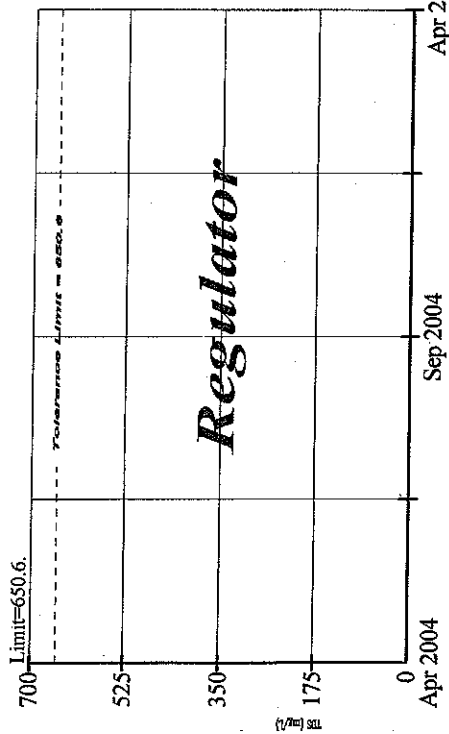
⇒

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:22 AM Client: Regulatory Use View: BAF-MW2(01-05)

TDS

v.8.5.09. For regulatory purposes only. CAS# n/a. EPA n/a. 0.05

PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW2



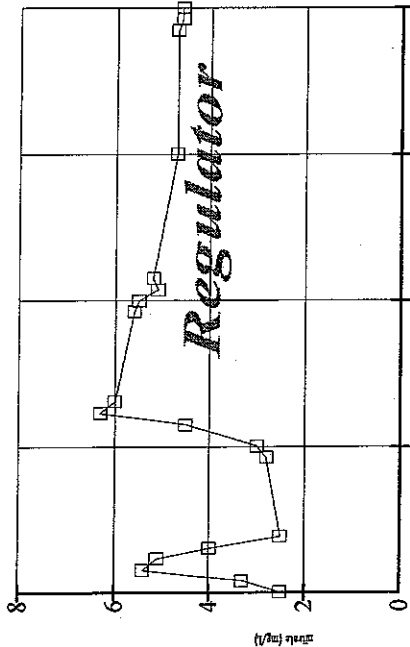
95% coverage. Background Data Summary: Mean=621.9, Std. Dev.=8.454, 0% n/a, 7 obs. Normality test used: Shapiro Wilk. W for background data = 0.9453. W Quantile = 0.803. Testwise alpha = 0.05.

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW2(01-05)
Date: 9/9/05, 10:26 AM Client: Regulatory Use View: BAF-MW2(01-05)

Nitrate

v.8.5.09, For regulatory purposes only, CAS# w/a EPA m.a. 0.05

OUTLIER ANALYSIS MW3



Jan 2001

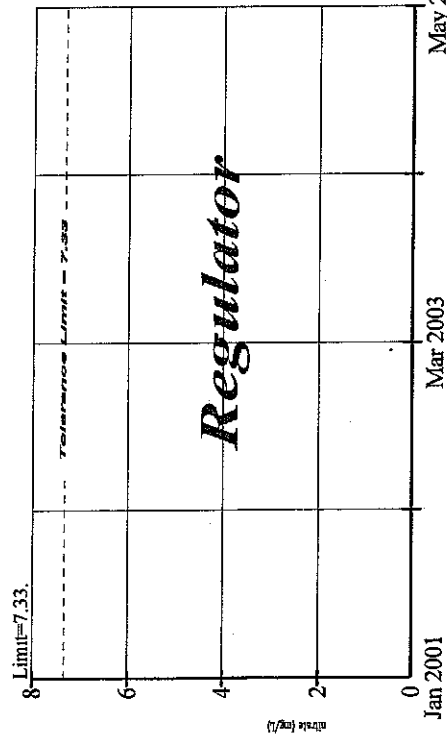
Mar 2003

May 2005

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
Date: 9/9/05, 10:39 AM Client: Regulatory Use View: BAF-MW3(01-05)

v.8.5.09, For regulatory purposes only, CAS# w/a EPA m.a. 0.05

PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW3



Jan 2001

Mar 2003

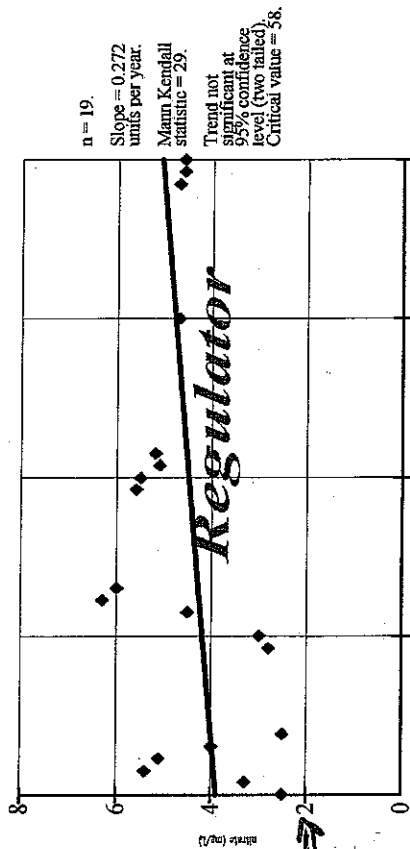
May 2005

95% coverage. Background Data Summary: Mean = 4.495, Std. Dev = 1.17, 0% obs. Normality test used: Shapiro Wilk. W for background data = 0.9257, W Quantile = 0.901, Testwise alpha = 0.05.

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
Date: 9/9/05, 10:41 AM Client: Regulatory Use View: BAF-MW3(01-05)

v.8.5.09, For regulatory purposes only, CAS# w/a EPA m.a. 0.05

SEN'S SLOPE ESTIMATOR MW3



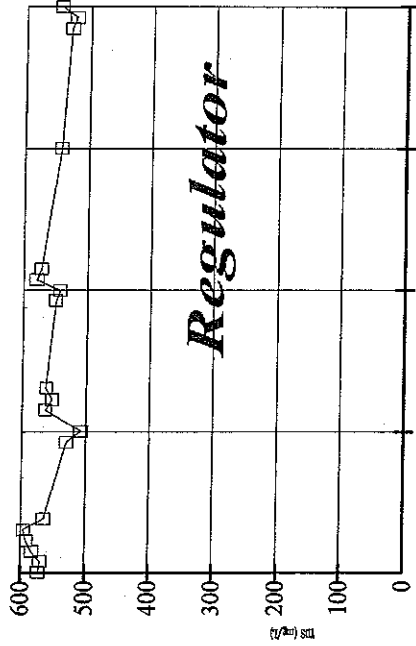
Jan 2001

Mar 2003

May 2005

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
Date: 9/9/05, 10:40 AM Client: Regulatory Use View: BAF-MW3(01-05)

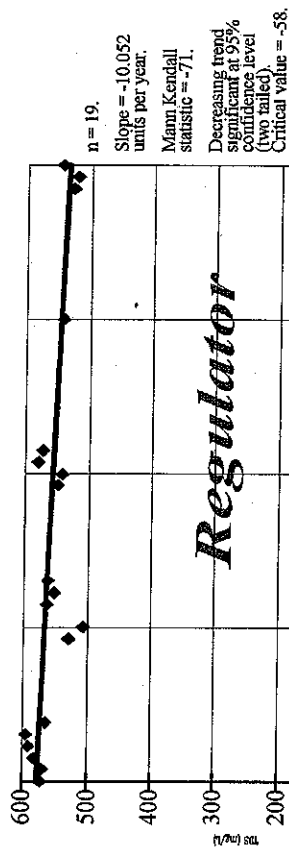
OUTLIER ANALYSIS MW3



Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
Date: 9/9/05, 11:18 AM Client: Regulatory Use View: BAF-MW3(01-05)

TDS

SEN'S SLOPE ESTIMATOR MW3



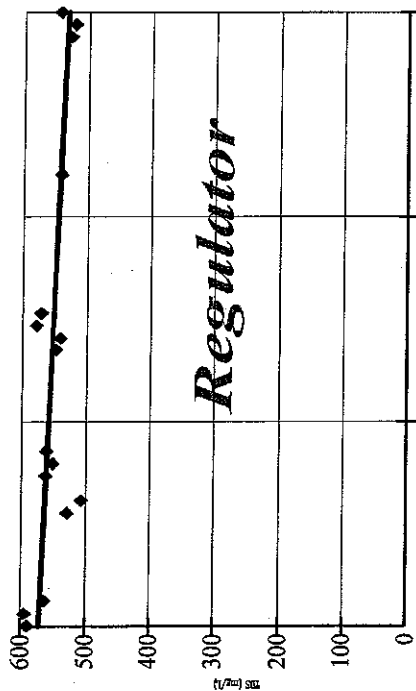
Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
Date: 9/9/05, 11:19 AM Client: Regulatory Use View: BAF-MW3(01-05)

Eliminate Jan 01 - Mar 01
to get no signif trend →

TDS

v.8.5.09, For regulatory purposes only. CAS# 414 EPA m.a. 0.05

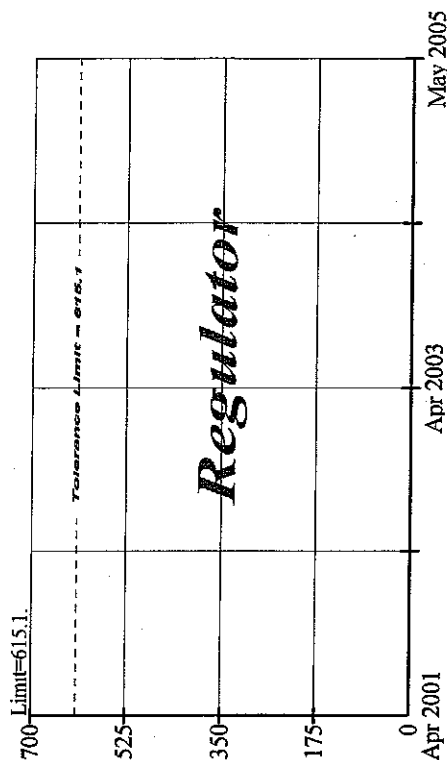
SEN'S SLOPE ESTIMATOR MW3



Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
 Date: 9/9/05, 11:22 AM Client: Regulatory Use View: BAF-MW3(01-05)

v.8.5.09, For regulatory purposes only. CAS# 414 EPA m.a. 0.05

PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW3

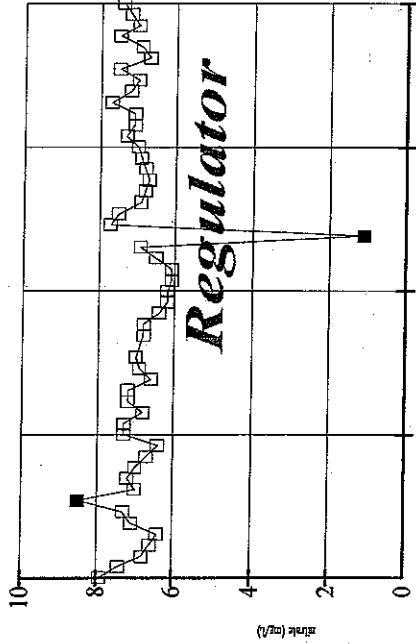


95% coverage. Background Data Summary: Mean=552.3, Std. Dev.=24.87, 0% nbs, 16 obs. Normality test used: Shapiro Wilk. for background data = 0.9813, W Quantile = 0.887, Testwise alpha = 0.05.

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW3(01-05)
 Date: 9/9/05, 11:22 AM Client: Regulatory Use View: BAF-MW3(01-05)

Nitrate

OUTLIER ANALYSIS MW12



Log-transformed:
Mean = 1.907 after
outlier removal 1.942,
Std. Dev. = 0.2643,
after outlier removal
0.0637, 0.06023.
Critical In = 2.971,
after outlier removal
2.964, 2.956.

Statistical outliers
are shown as solid squares.
Data, after outlier removal,
were found to be normally
distributed.
Normality test used:
Shapiro-Francia
W Statistic = 0.9808
W Quantile = 0.953

Jan 2001 Mar 2003 May 2005
Note: EPA guidance directs that statistical outliers should not be removed or altered unless independent evidence of an error exists.

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:29 AM Client: Regulatory Use View: BAF-MW12(01-05)

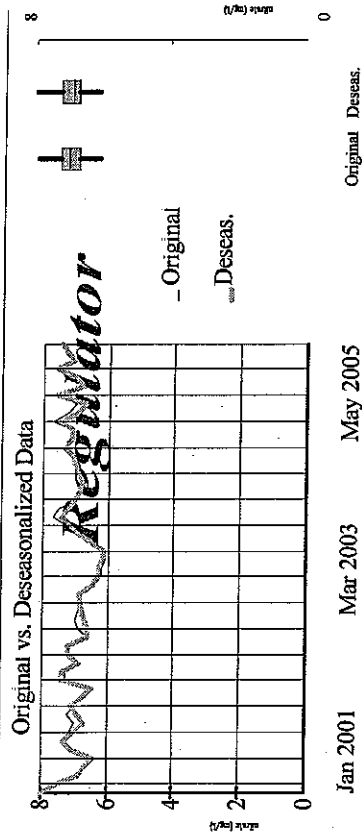
SEASONALITY: MW12

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.

Calculated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

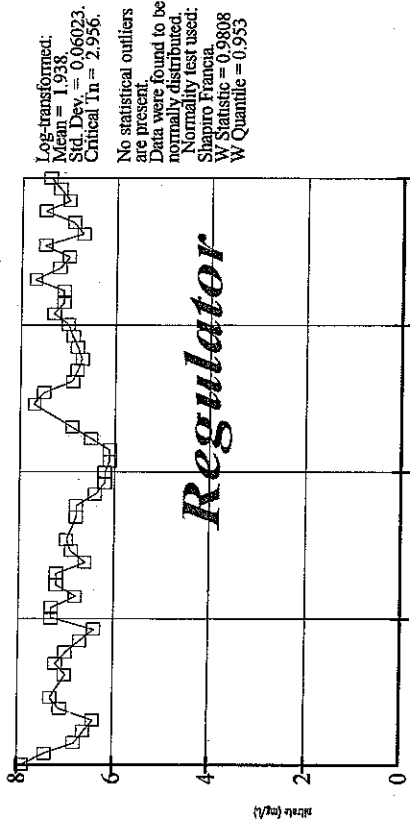
There were 14 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H) was adjusted.

Kruskal-Wallis statistic: (H) = 6.177
Adjusted Kruskal-Wallis statistic (H) = 6.213



Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:31 AM Client: Regulatory Use View: BAF-MW12(01-05)

OUTLIER ANALYSIS MW12



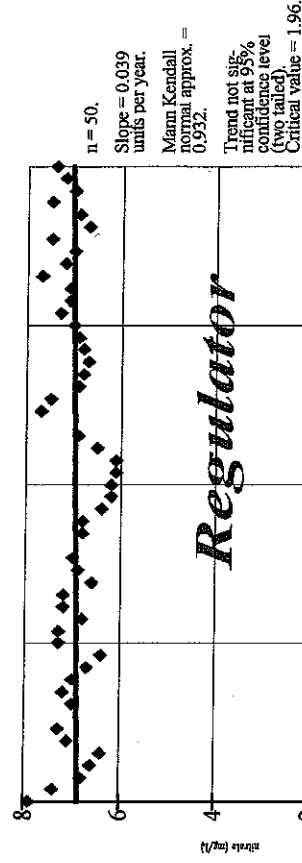
Log-transformed:
Mean = 1.938
Std. Dev. = 0.06023.
Critical In = 2.956.

No statistical outliers
are present.
Data were found to be
normally distributed.
Normality test used:
Shapiro-Francia
W Statistic = 0.9808
W Quantile = 0.953

Jan 2001 Mar 2003 May 2005

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:31 AM Client: Regulatory Use View: BAF-MW12(01-05)

SEN'S SLOPE ESTIMATOR MW12



n = 50.
Slope = 0.039
units per year.
Mann Kendall
normal approx. =
0.932.
Trend not sig-
nificant at 95%
confidence level
(two tailed)
Critical value = 1.96.

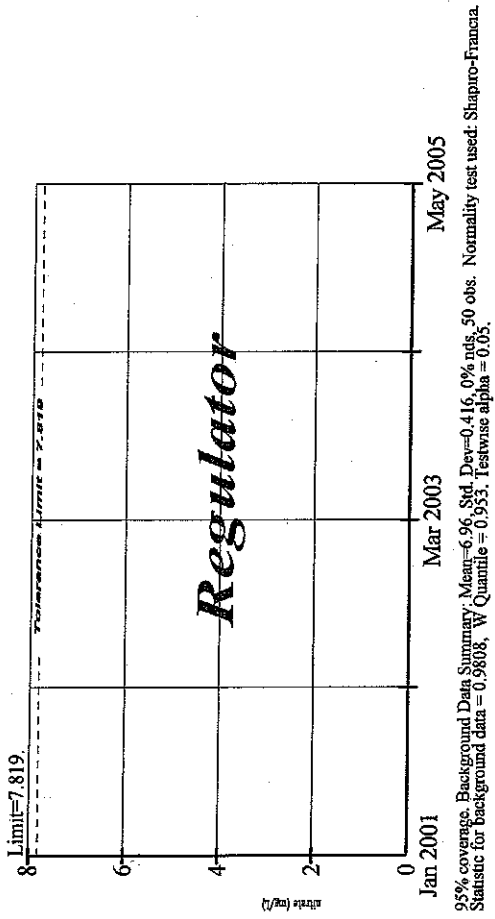
Jan 2001 Mar 2003 May 2005

Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:32 AM Client: Regulatory Use View: BAF-MW12(01-05)

Nitrate

v8.1.09 For regulatory purposes only. CAS9 m/a EPA m.a. 0.05

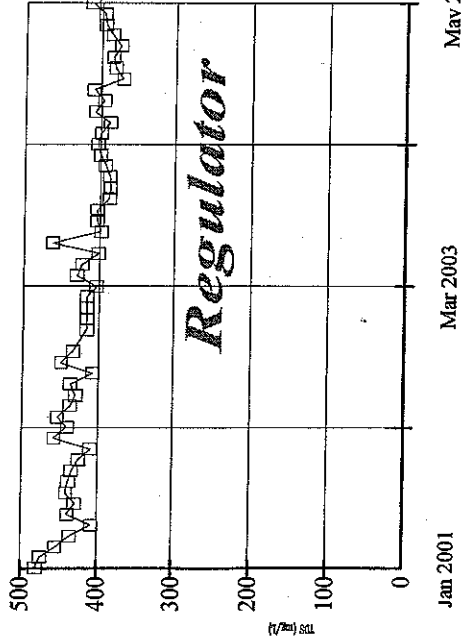
PARAMETRIC INTRA-WELL TOLERANCE LIMIT
MW12



Constituent: nitrate (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:35 AM Client: Regulatory Use View: BAF-MW12(01-05)

TDS

OUTLIER ANALYSIS MW12

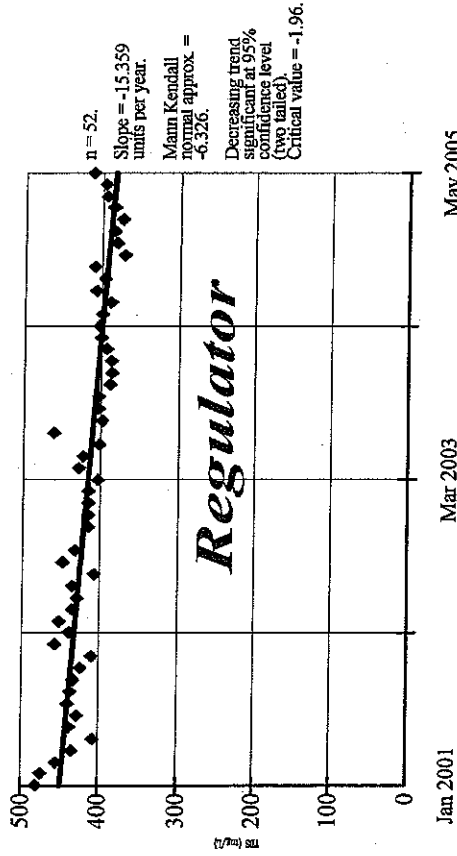


Log-transformed:
Mean = 6.028
Std. Dev. = 0.06081
Critical Tn = 2.971
No statistical outliers
are present.
Data were found to be
normally distributed.
Normality test used:
Shapiro-Francia
W Statistic = 0.9729
W Quantile = 0.9555

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Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:42 AM Client: Regulatory Use View: BAF-MW12(01-05)

SEN'S SLOPE ESTIMATOR MW12

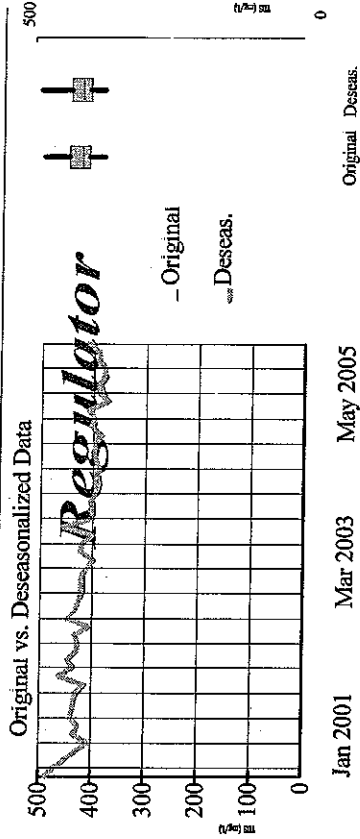


n = 52
Slope = -15.359
units per year.
Mann Kendall
normal approx. =
-6.326.
Decreasing trend
significant at 95%
confidence level
(two tailed).
Critical value = -1.96.

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:43 AM Client: Regulatory Use View: BAF-MW12(01-05)

SEASONALITY: MW12

For the data shown, the Kruskal-Wallis test indicates NO SEASONALITY at the 5% significance level. Because the calculated Kruskal-Wallis statistic is less than or equal to the Chi-squared value, we conclude that no season has a significantly different median concentration of this constituent than any other season.
Calculated Kruskal-Wallis statistic = 2.005
Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.
There were 8 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H')
Kruskal-Wallis statistic (H) = 2.003
Adjusted Kruskal-Wallis statistic (H') = 2.005



- Original
- Descas.

Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:42 AM Client: Regulatory Use View: BAF-MW12(01-05)

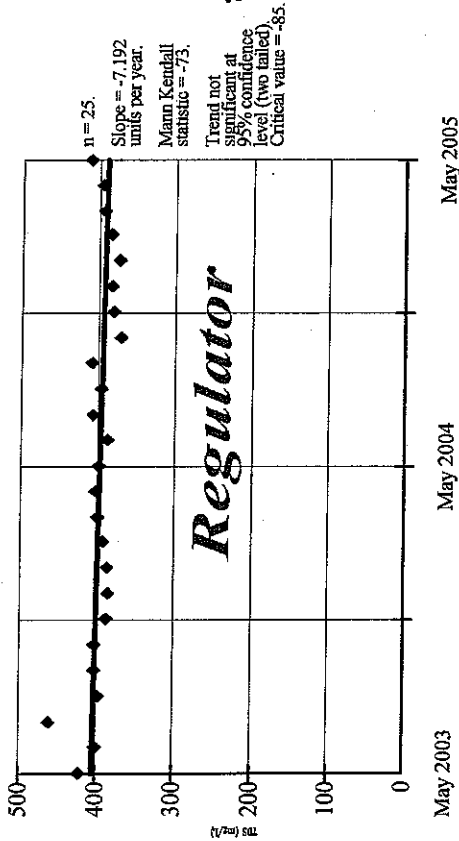
Eliminate Jan 01 - Apr 03
to get no signif decr trend

⇒

⇒

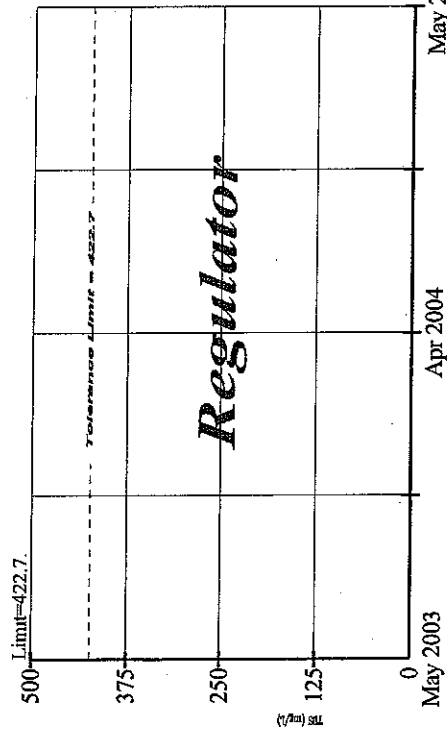
TDS

SEN'S SLOPE ESTIMATOR MW12



Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:47 AM Client: Regulatory Use View: BAF-MW12(01-05)

PARAMETRIC INTRA-WELL TOLERANCE LIMIT MW12

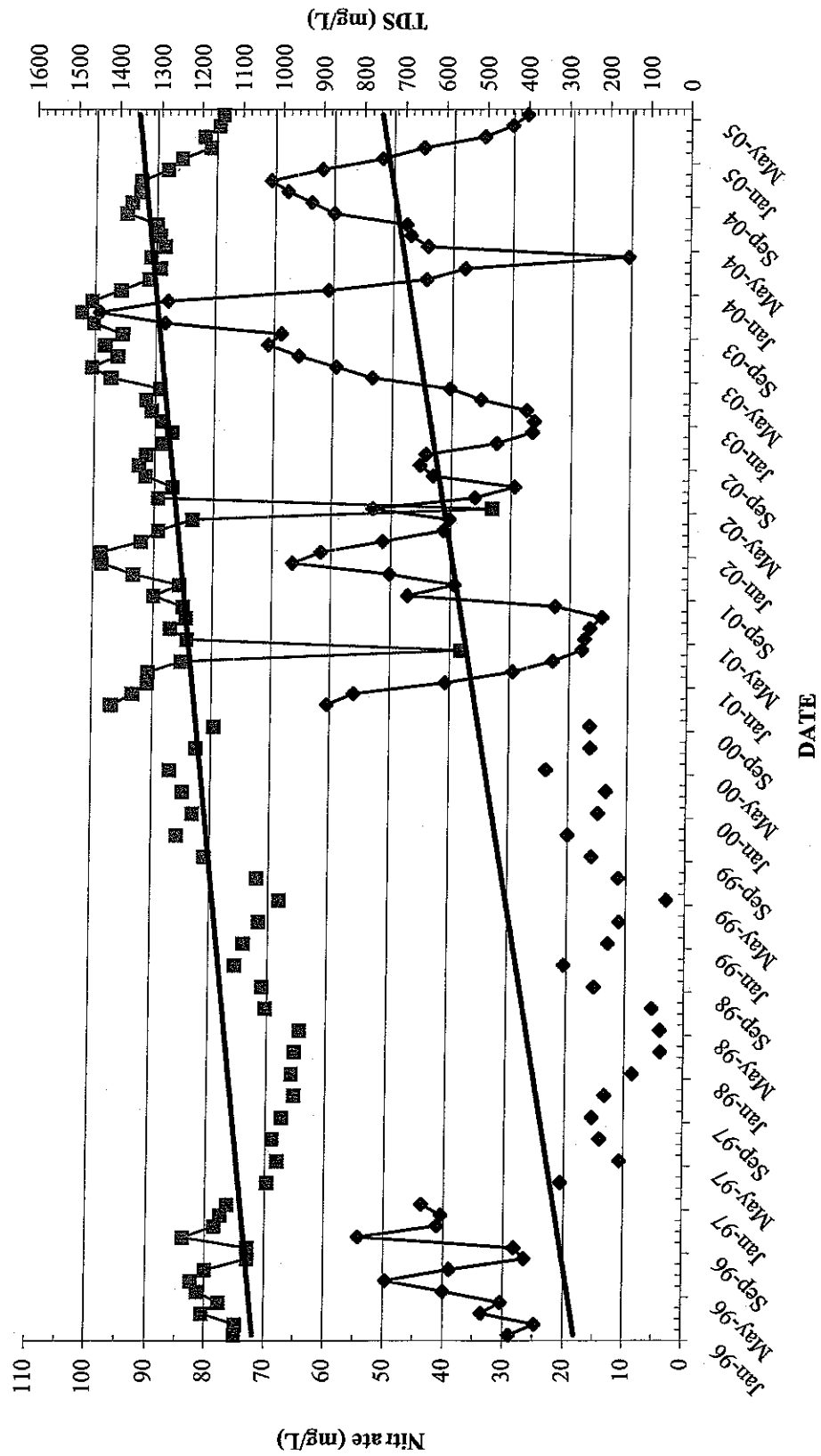
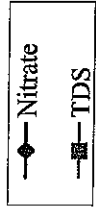


Constituent: TDS (mg/L) Facility: Landfill X Data File: BAF-MW12(01-05)
Date: 9/9/05, 11:49 AM Client: Regulatory Use View: BAF-MW12(01-05)

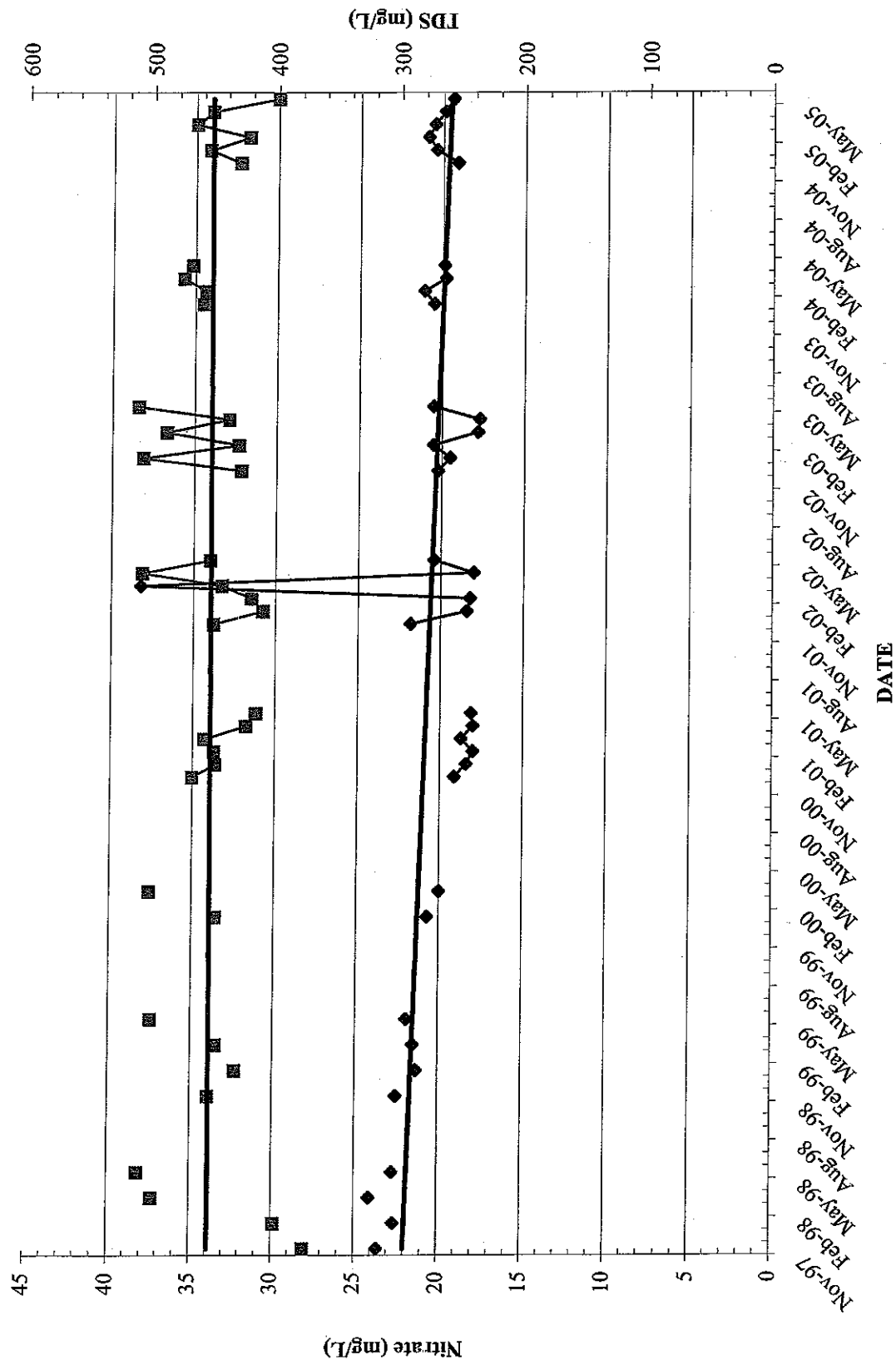
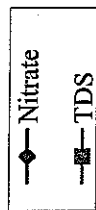
ADDENDUM 3

Downgradient Ground Water Analysis

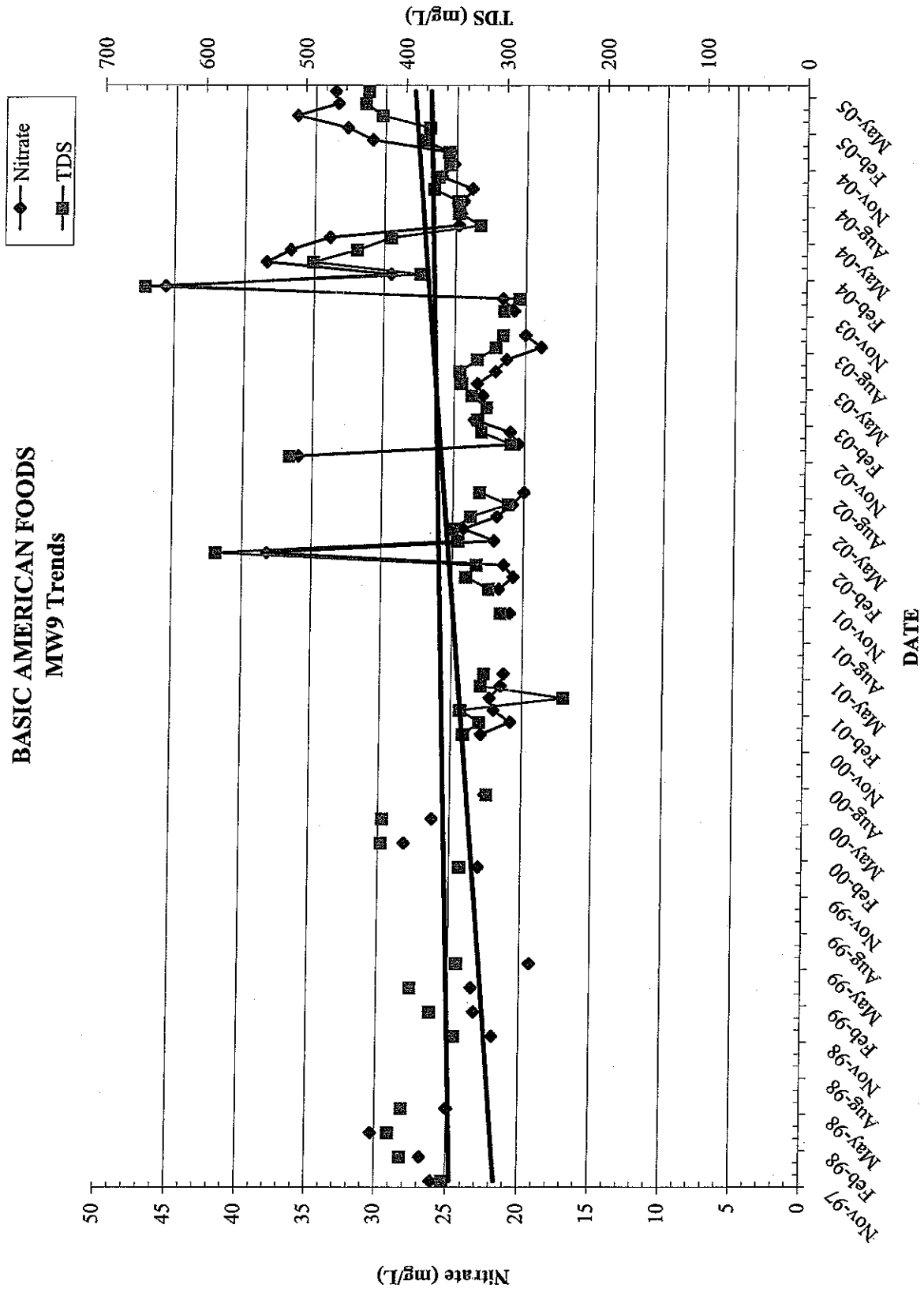
BASIC AMERICAN FOODS **MW6 Trends**



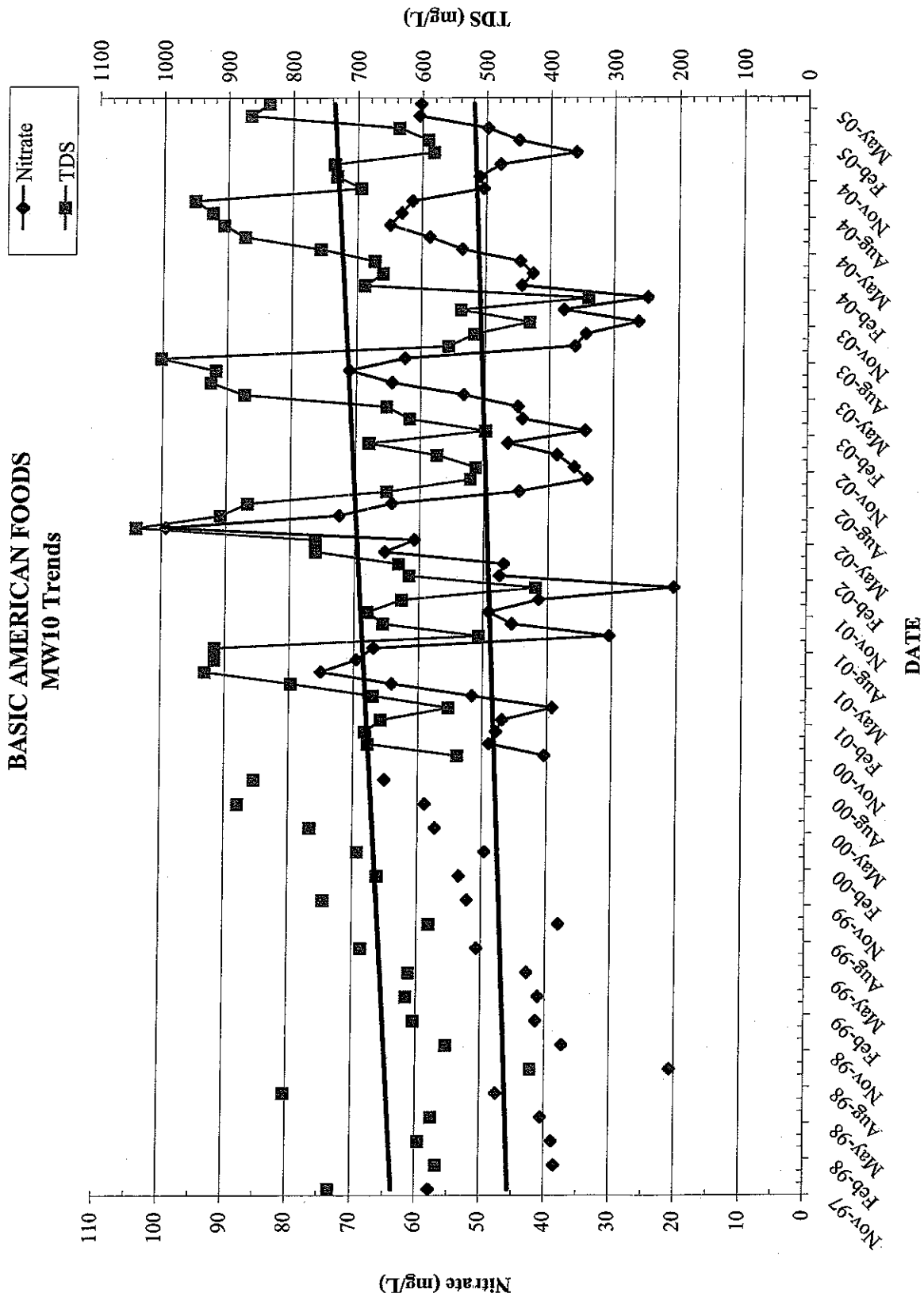
BASIC AMERICAN FOODS MW8 - Trends



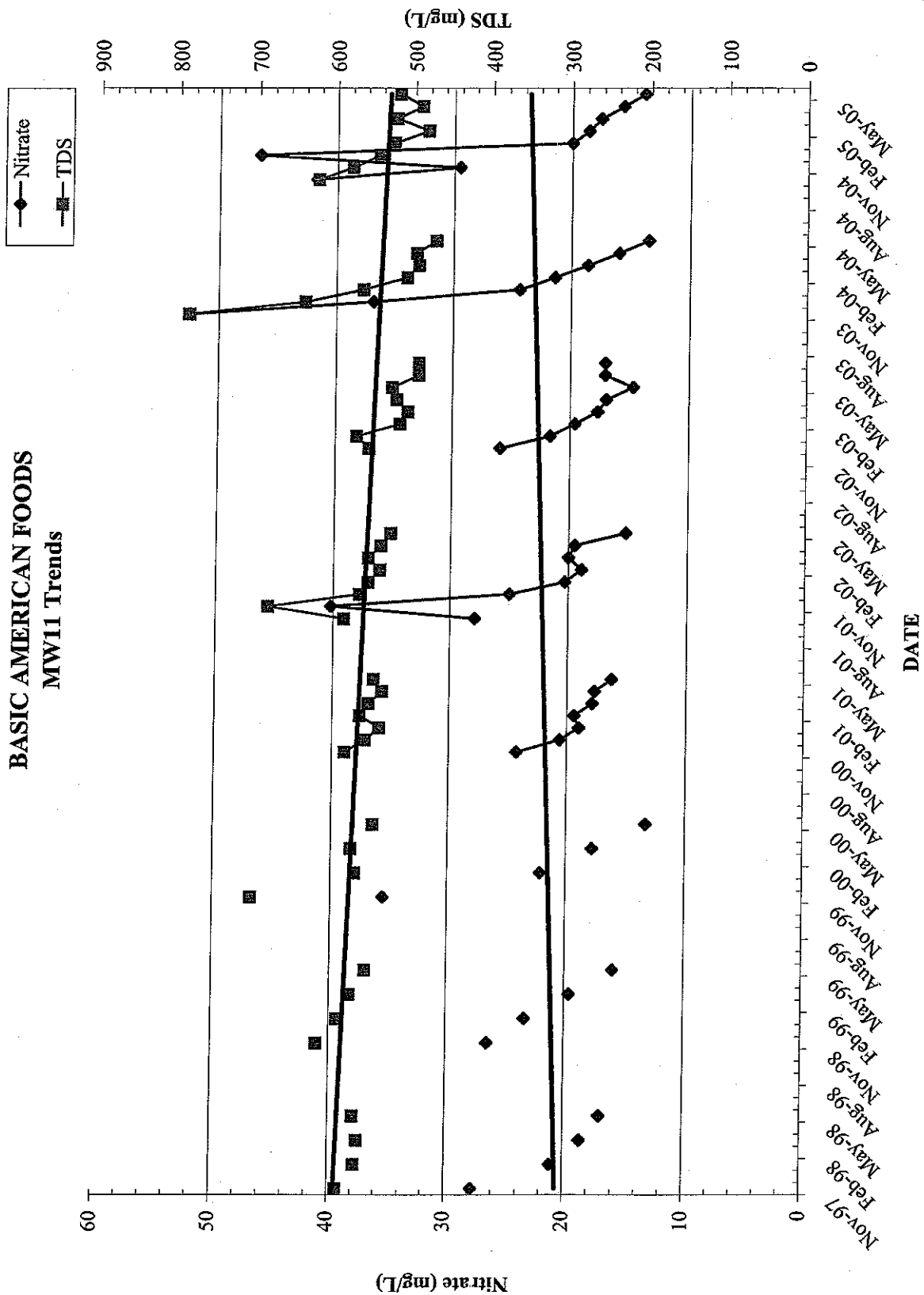
**BASIC AMERICAN FOODS
MW9 Trends**



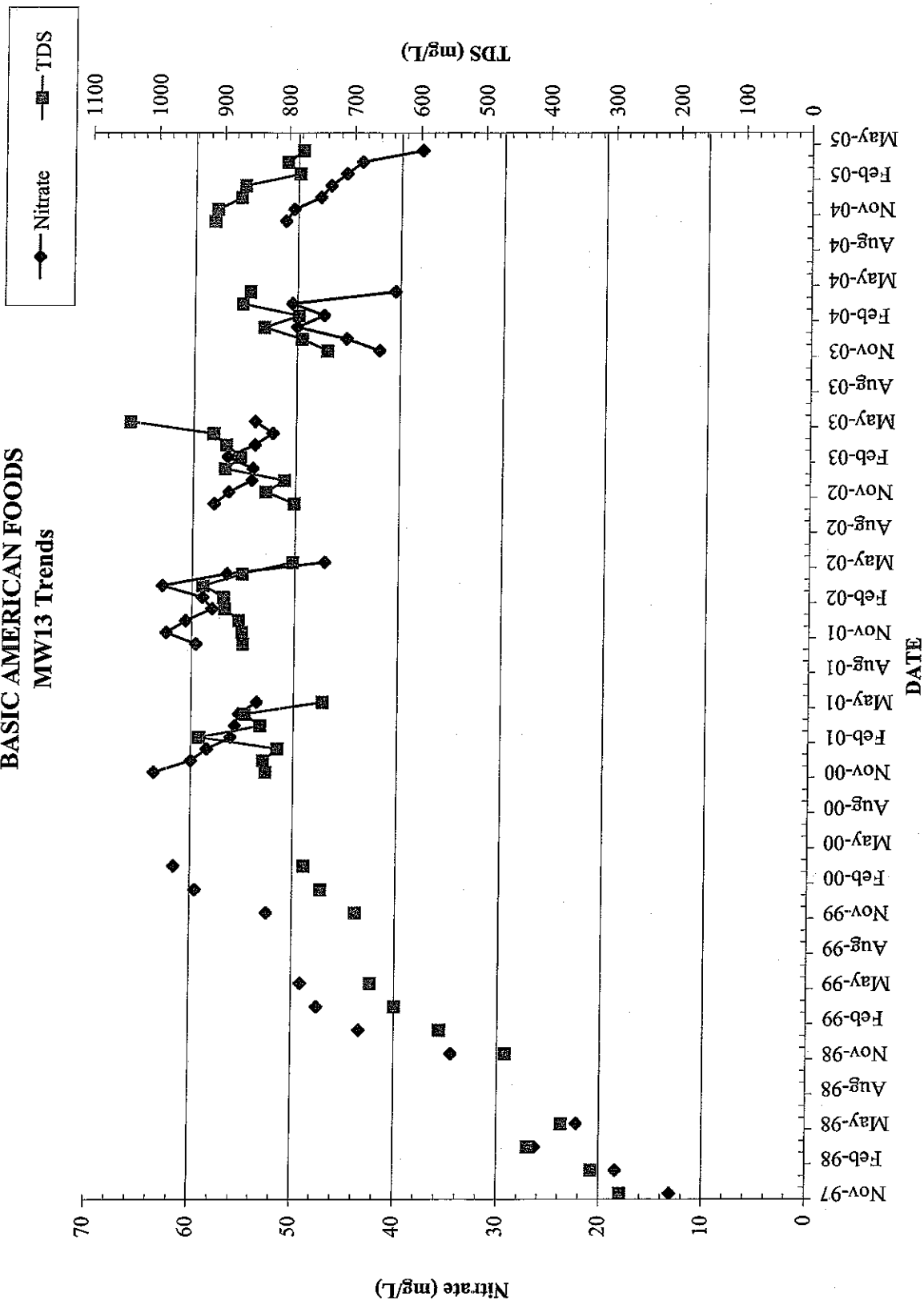
BASIC AMERICAN FOODS MW10 Trends



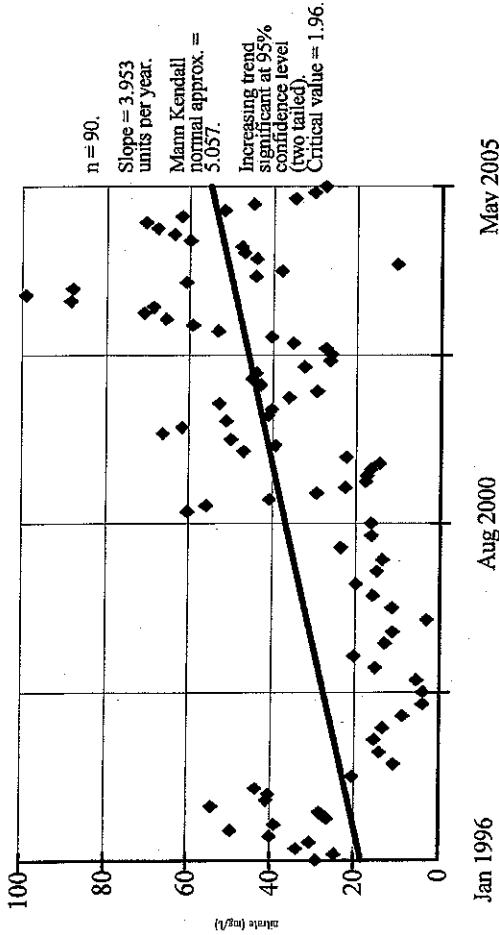
BASIC AMERICAN FOODS **MW11 Trends**



BASIC AMERICAN FOODS MW13 Trends

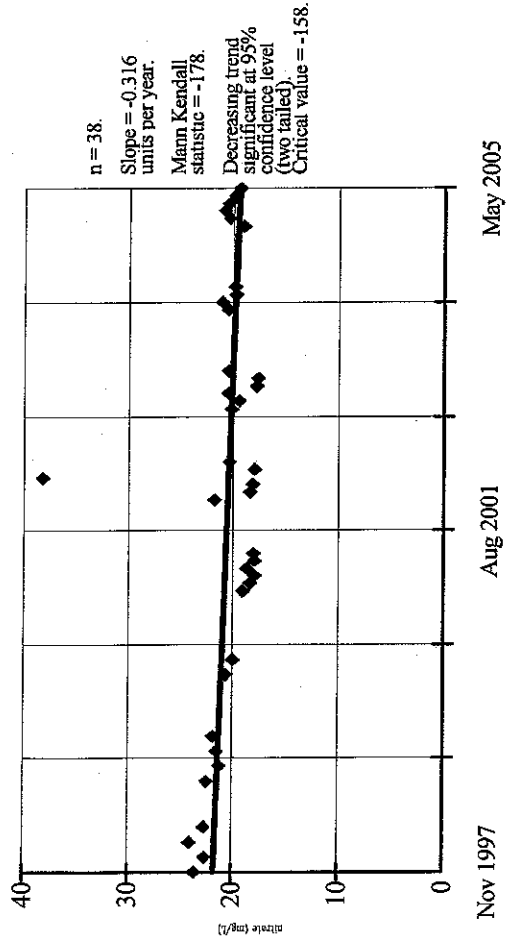


SEN'S SLOPE ESTIMATOR MW6



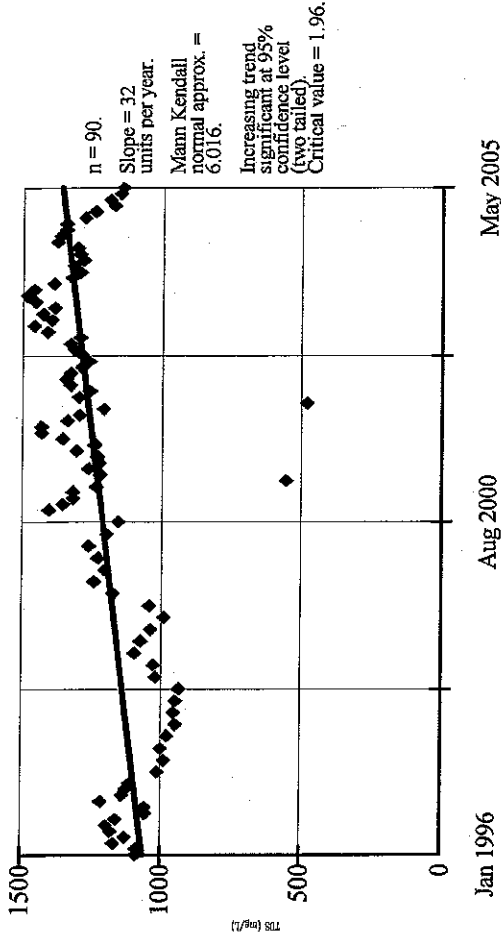
Constituent: nitrate (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:47 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW8



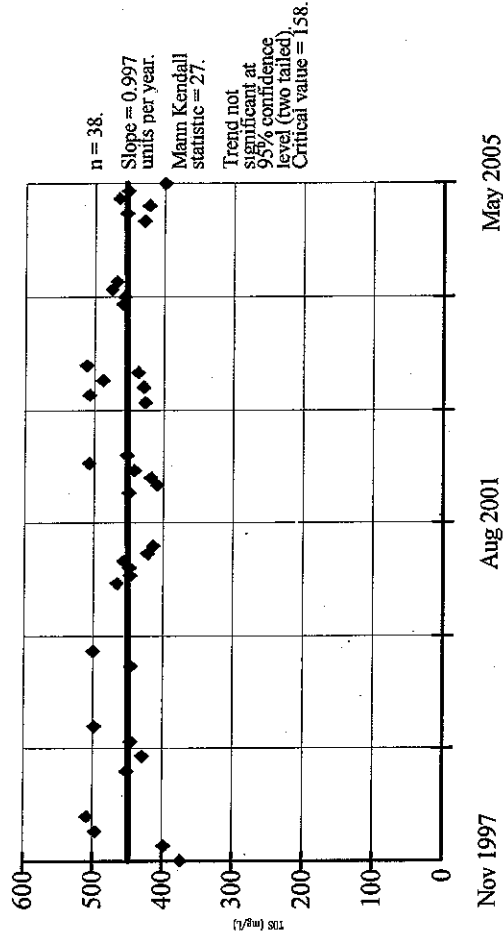
Constituent: nitrate (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:49 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW6



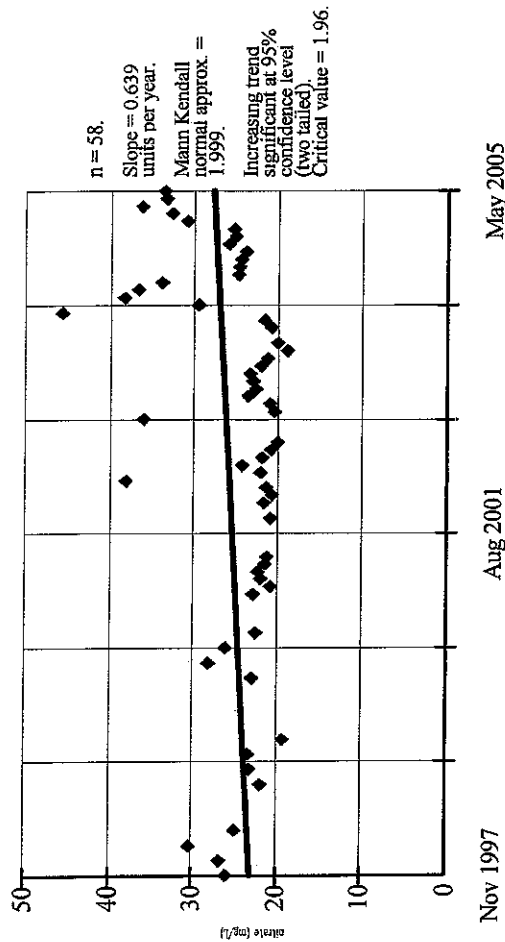
Constituent: TDS (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:48 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW8



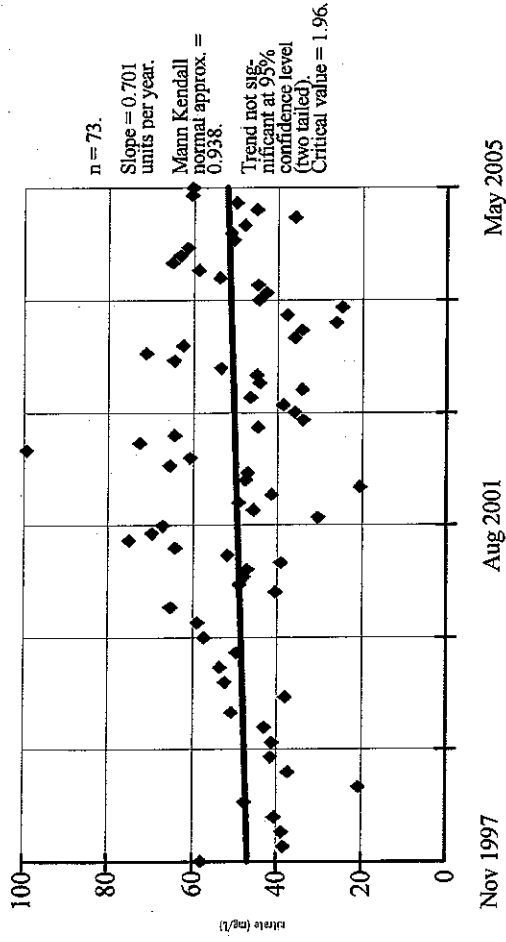
Constituent: TDS (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:50 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW9



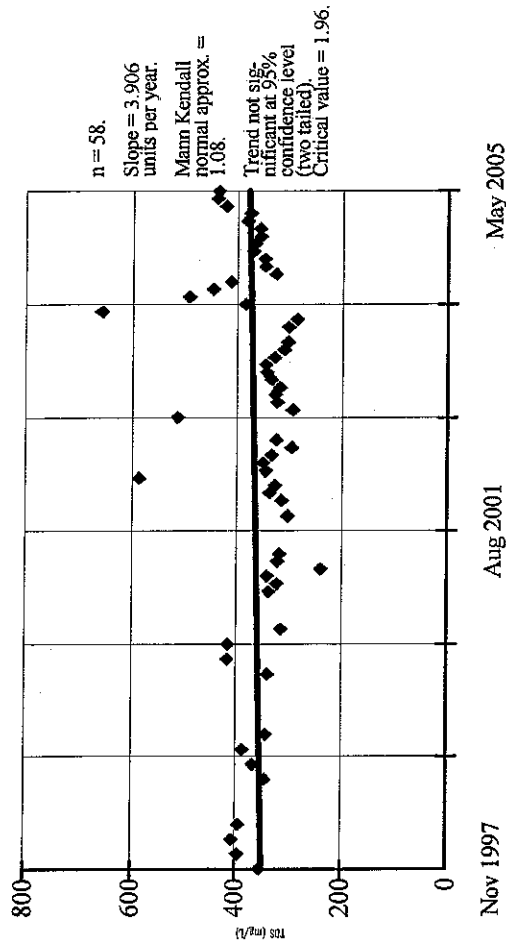
Constituent: nitrate (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:53 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW10



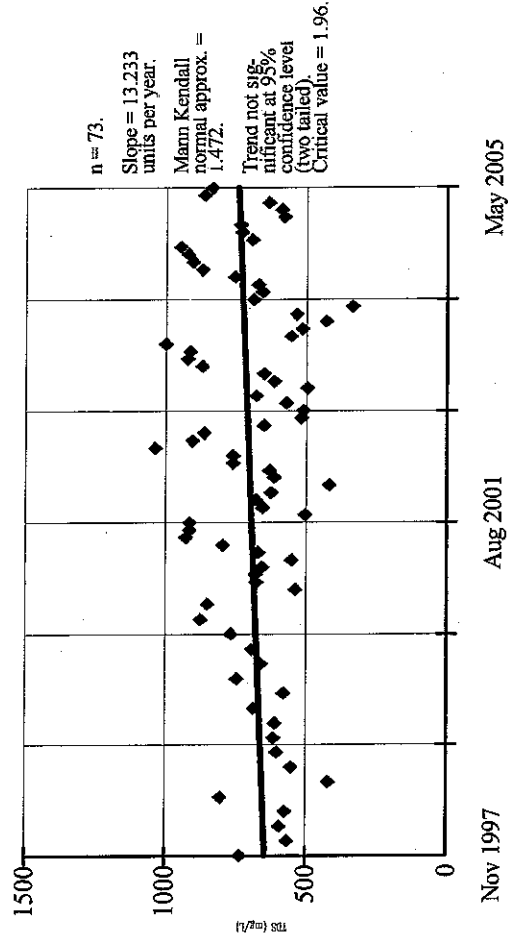
Constituent: nitrate (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:54 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW9



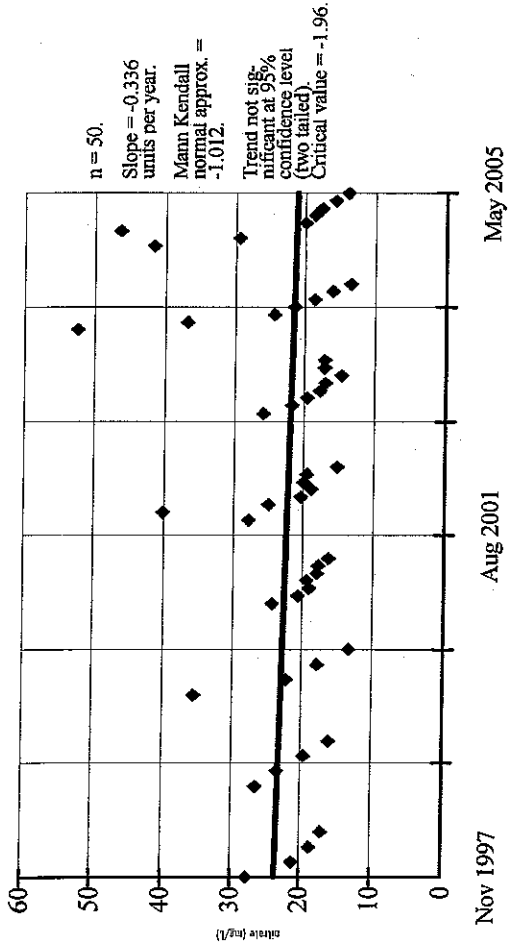
Constituent: TDS (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:54 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW10



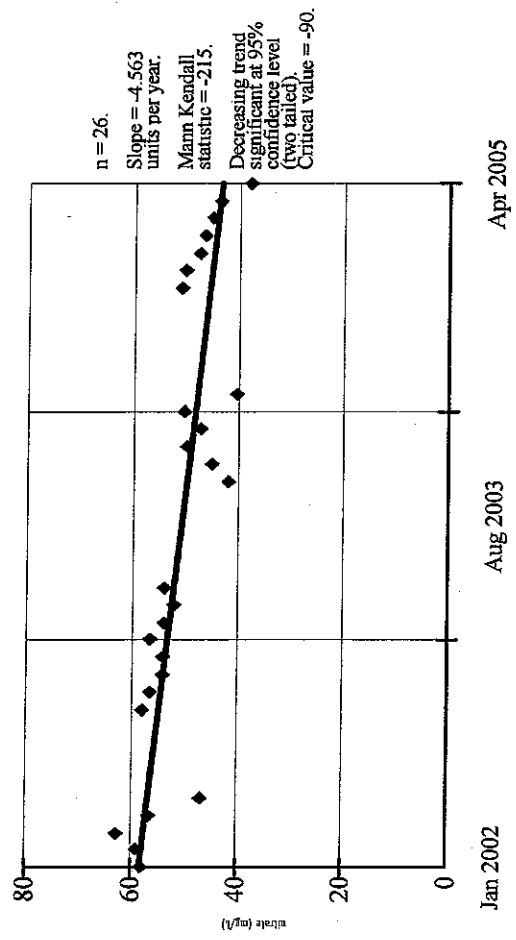
Constituent: TDS (mg/L) Facility: Discharger Data File: BAF Downgradient(96-05)
Date: 3/6/06, 3:54 PM Client: Regulatory Use Only View: BAF downgradient

SEN'S SLOPE ESTIMATOR MW11



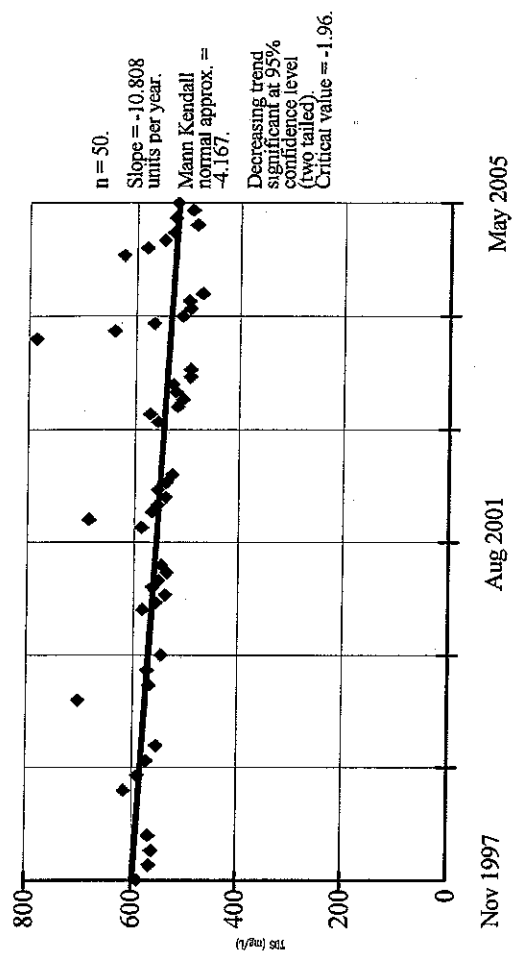
v8.6.005, FOR USE BY STATE REGULATORS ONLY. EPA

SEN'S SLOPE ESTIMATOR MW13



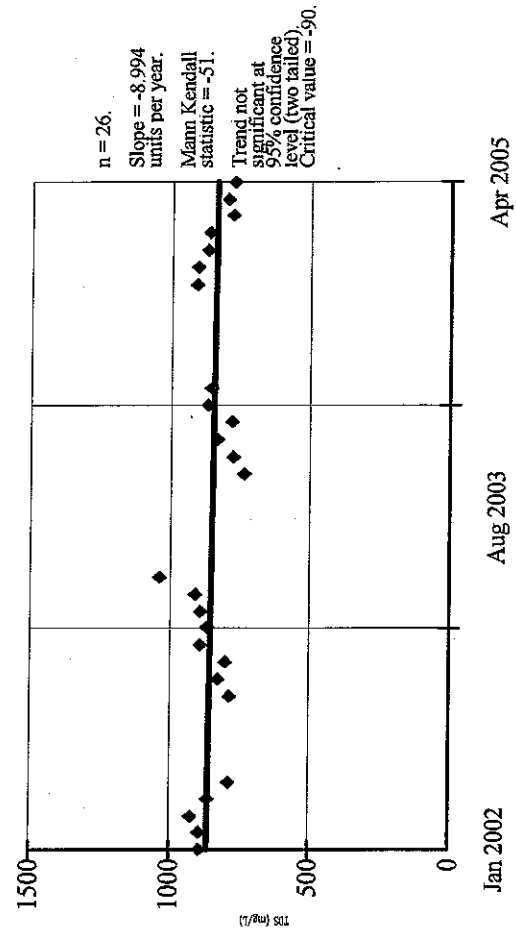
v8.6.005, FOR USE BY STATE REGULATORS ONLY. EPA

SEN'S SLOPE ESTIMATOR MW11



v8.6.005, FOR USE BY STATE REGULATORS ONLY. EPA

SEN'S SLOPE ESTIMATOR MW13



v8.6.005, FOR USE BY STATE REGULATORS ONLY. EPA